United States
Department of
Agriculture

Soil
Conservation
Service

1989/90 ANNUAL REPORT

Cape May Plant Materials Center

Cape May Court House, NJ

PERSONNEL

Manager	Donald W. Hamer	
Soil Conservationist	Michael R. Fournier	(from 6/3/90)
Agronomist	James G. Kube	(resigned 8/18/89)
Agronomist Trainee	Randy H. Mandel	(from 7/17/89)
Agronomist	Dr. Sandra J. Primard	(from 7/20/90)
Foreman	Wilson J. Merrick	
Biological Technician	Noel J. Murray	
Secretary	Barbara A. Turnier	
Student Trainee	Victor Hartley	(6/18/89-9/8/89)
Biological Aid	William Carey	(3/12/89-11/4/89)
Biological Aid	Harold Livingston	(3/27/90-7/16/90)
Biological Aid	Tom Lucas	(6/25/90-9/24/90)
Biological Aid	Peter McFadden	(4/23/89-11/3/89)
		Vol.(12/3/89-1/27/90)
		(3/11/90-11/17/90)

PLANT MATERIALS SPECIALISTS

W. Curtis Sharp	National Plant Materials Specialist
David G. Lorenz	NENTC Plant Materials Specialist
Cluster R. Belcher	NJ Plant Materials Specialist
Stephen K. Salvo	NC Plant Materials Specialist

CAPE MAY PMC STATE CONSERVATIONISTS' ADVISORY COMMITTEE

Barbara T. Osgood, Chairperson	NJ State Conservationist
Rex Tracey	MA State Conservationist
Bobbye Jack Jones	NC State Conservationist
George Norris	VA State Conservationst

TABLE OF CONTENTS

Trade names used herein are for convenience only. No endorsement of products is intended, nor is criticism of unnamed products implied.

INTRODUCTION

History & Origin

The activities of the Cape May Plant Materials Center (CM PMC), for the calendar years of 1989 and 1990 are contained in this report. The PMC is solely operated by the United States Department of Agriculture's Soil Conservation Service (USDA-SCS) in the state of New Jersey. The 88 acre Cape May PMC was established in 1965 after extensive storm damage had eroded much of the Mid-Atlantic coastline. Since its establishment 25 years ago, there have been four center managers: Dr. V. Hawk, F. Gaffney, C. Belcher and currently D. Hamer; all who have been responsible for meeting the challenges faced by the Cape May PMC. The service area of this PMC is served by two Plant Materials Specialists stationed in North Carolina and New Jersey.

The Cape May PMC has been given the task of developing and promoting new and improved plants, as well as improving cultural methods and management techniques for conserving our vital natural resources. The primary objectives of the Cape May PMC in producing improved plants for conservation use include:

- Reduce excessive cropland erosion.
- Reduce coastal shoreline and tidal bank erosion.
- Improve water quality.
- Conserve natural resources in urban and rural areas.
- Improve organic waste management techniques
- Improve grassland management techniques and forage quality
- Improve habitat for fish and wildlife

Although, the Cape May PMC has traditionally concentrated on reducing coastal sand dune and tidal bank erosion, the use of plant materials to improve water quality and establish artificial wetlands has become the priority for its service area. The Cape May PMC will meet these newly prioritized objectives as we enter into the new decade of the 90's. The procedure by which the center develops and promotes plant materials to meet such objectives is as follows:

-- Collect and evaluate plant materials including native collections, foreign plant introductions and strains from plant breeders.

-- Increase seed and/or plants of potential new releases.

-- Make advanced evaluations of selected accessions under simulated field conditions in comparison with a standard variety.

-- Determine cultural requirements of needed plant materials.

-- Make off-center plantings on problem sites to obtain information on plants for eventual use on these sites.

-- Provide plant propagules for field plantings to Soil and Water Conservation Districts where the final evaluation of a new plant is to be made.

-- Develop, name and release new varieties in cooperation with the New Jersey Agricultural Experiment Station or other cooperating agencies.

-- Maintain and produce breeder or foundation seed or stock of released varieties at the center in accordance with standards of the cooperating agency.

Location & Site Description

The Cape May Plant Materials Center is located in New Jersey's southern most county of Cape May. The center is approximately 24 miles south of Atlantic City, New Jersey sandwiched between the Garden State Parkway and US Route 9. Approximately, 500 feet east of the PMC starts the tidal marsh which surrounds Great Sound, a body of water lying between the PMC and the Borough of Avalon.

The climate at the Cape May PMC varies from semi-humid to semi-maritime conditions with average precipitation at 41 inches. During periods when precipitation is below normal, a deep 5.5 acre pond, on the PMC, is utilized for irrigation. The average annual maximum and minimum temperatures at the PMC are 62ˆF and 44ˆF, respectively. The Cape May PMC lies in Plant Hardiness Zones 7b, with approximately a 190 day growing season.

The soils on the Cape May PMC are the product of wind mixed marine soils and glacial outwash which has weathered since the Pleistocene Age. The Downer, Sassafras, Fort Mott, and Woodstown soil series are all found on this property with the Downer and Sassafras predominating the acreage. The soils on the Cape May PMC can be generally described as nearly level, well drained, with low to moderate naturally fertile soils which are found at higher land locations. These soils encountered at the Cape May PMC are usually strongly acid in their natural state. The surface feature of these soils ranges from sand to loamy sand. Most fruits and vegetables can be grown on these soils but irrigation is a necessity to insure success. The elevations of

the PMC range from 12 to 22 feet above sea level, with slope not exceeding one percent. The four soil series listed above have Soil Capability Classes ranging from I for the Sassafras series to III for the Fort Mott series. When trees are considered for production, the site indices for native oak, hickories, gums and pines range from 66 to 85.

Agricultural operations are predominantly cash row crops, orchards, truck crops, specialty crops, and poultry. Livestock enterprises have disappeared from many farms which have switched to continuous cultivated crops. This trend to cash crop operations has reduced the use of hay and pasture plants in the cropping systems. Clean cultivation on large tracts of land has increased soil erosion. The problem is especially prevalent on large open areas of flat sandy soils and all sloping land during periods of inadequate soil cover.

Nonagricultural activities play a dramatic role in the use of conservation plants. There is a large portion of this area covered by hardwood and pine forests, much of which is not managed. Extensive areas of tidal marsh are vital to the seafood and wildlife resources which are vital to this area's economy. Also, sand and gravel mining, expanding land transportation systems, increasing number of recreational facilities, and construction of industrial as well as residential developments, are all areas where plants can be used to stabilize disturbed sites.

Fifteen percent of the nation's population lives within commuting distance of the area served by the center. In most areas, an extensive summer resort industry has expanded into a year-round enterprise, creating a demand for high use recreational facilities.

A map illustrating the distribution of the Cape May PMC's Off-Center project sites follows which indicates the PMC's current workload (See Off-Center Project Location Map-page 9). The area served by the Cape May PMC includes the mid-Atlantic plain and the piedmont area, extending from Cape Cod, Massachusetts, to Cape Hatteras, North Carolina (See Service Area Map-page 10).

The states serviced by the Cape May PMC include the Major Land Resource Areas which are listed below.

Massachusetts

143 - Northeastern Mountains
144A - New England and Eastern New York Upland, Southern Part
144B - New England and Eastern New York Upland, Northern Part
145 - Connecticut Valley
149B - Long Island, Cape Cod Coastal Lowland

Connecticut
- 144A - New England and Eastern New York Upland, Southern Part
- 145 - Connecticut Valley

Rhode Island
- 144A - New England and Eastern New York Upland, Southern Part

New York
- 149B - Long Island - Cape Cod Coastal Lowland

New Jersey
- 144A - New England and Eastern New York Upland, Southern Part
- 148 - Northern Piedmont
- 149A - Northern Coastal Plain

Maryland
- 148 - Northern Piedmont
- 149A - Northern Coastal Plain
- 153B - Tidewater Area
- 153C - Mid-Atlantic Coastal Plain

Delaware
- 148 - Northern Piedmont
- 149A - Northern Coastal Plain
- 153C - Mid-Atlantic Coastal Plain

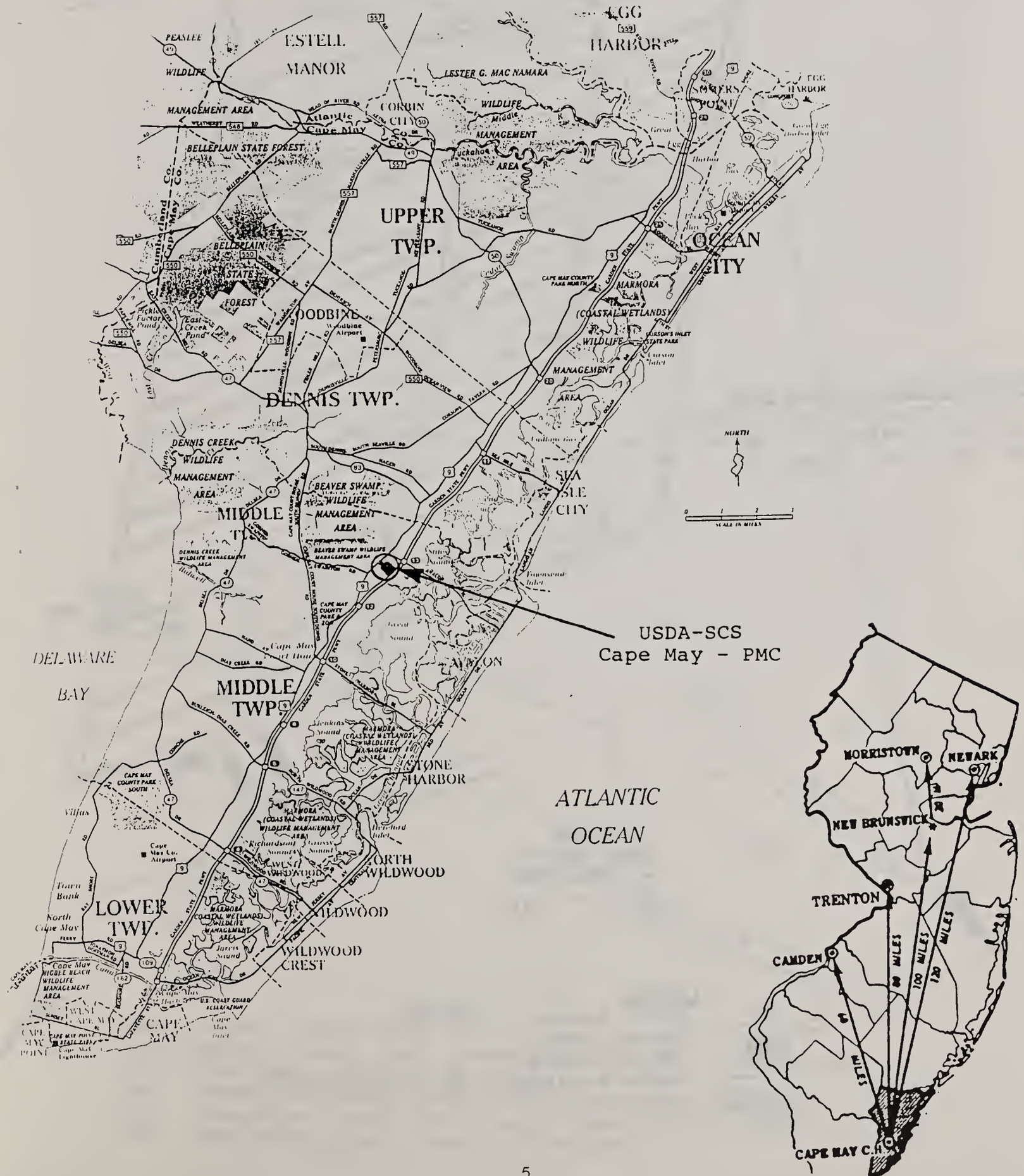
Virginia
- 133A - Southern Coastal Plain
- 136 - Southern Piedmont
- 153A - Atlantic Coast Flatwoods
- 153B - Tidewater Area
- 153C - Mid-Atlantic Coastal Plain

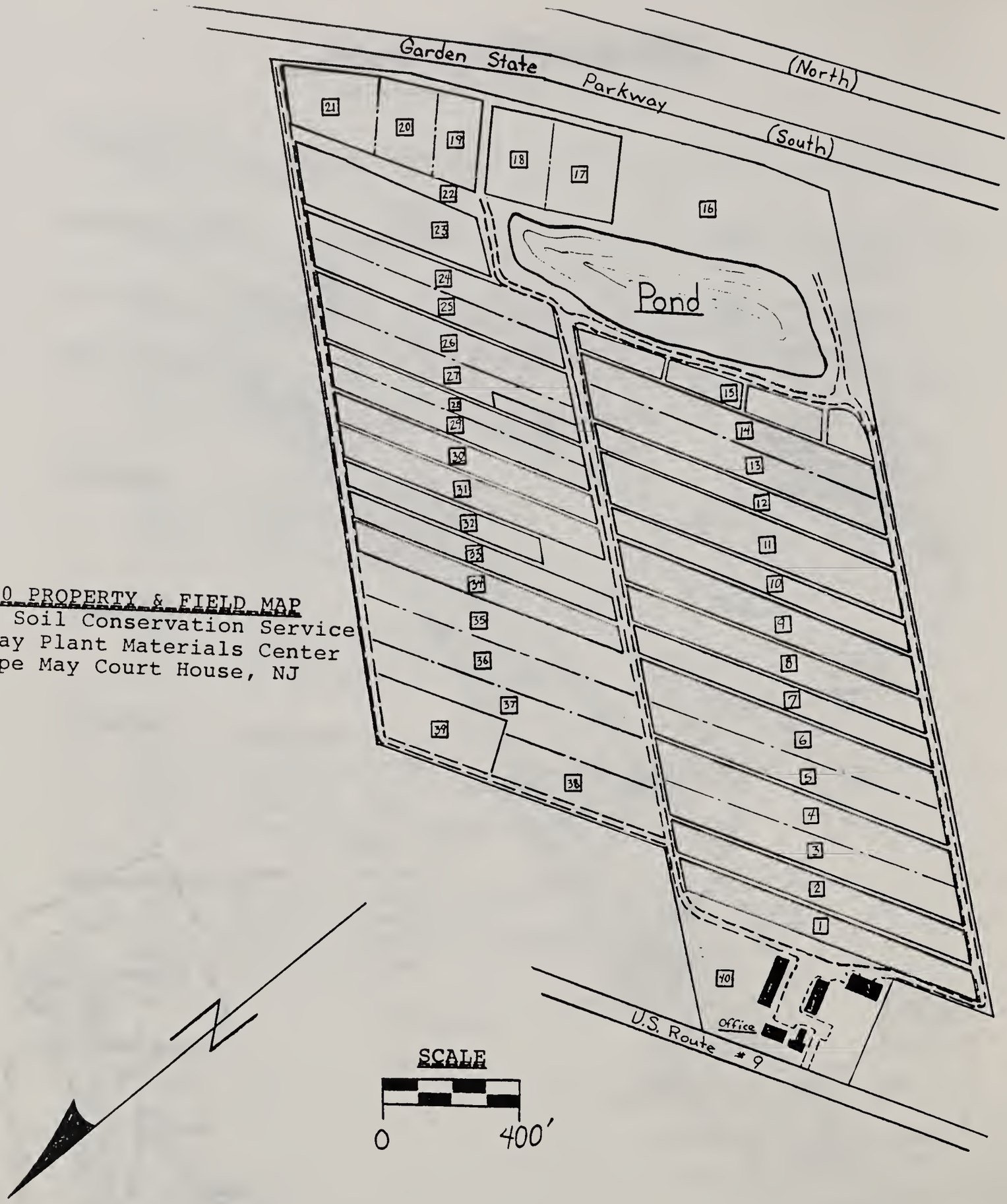
North Carolina
- 133A - Southern Coastal Plain
- 136 - Southern Piedmont
- 153A - Atlantic Coastal Flatwoods
- 153B - Tidewater Area

CAPE MAY - PMC LOCATION MAP

USDA - Soil Conservation Service

Cape May Court House, NJ

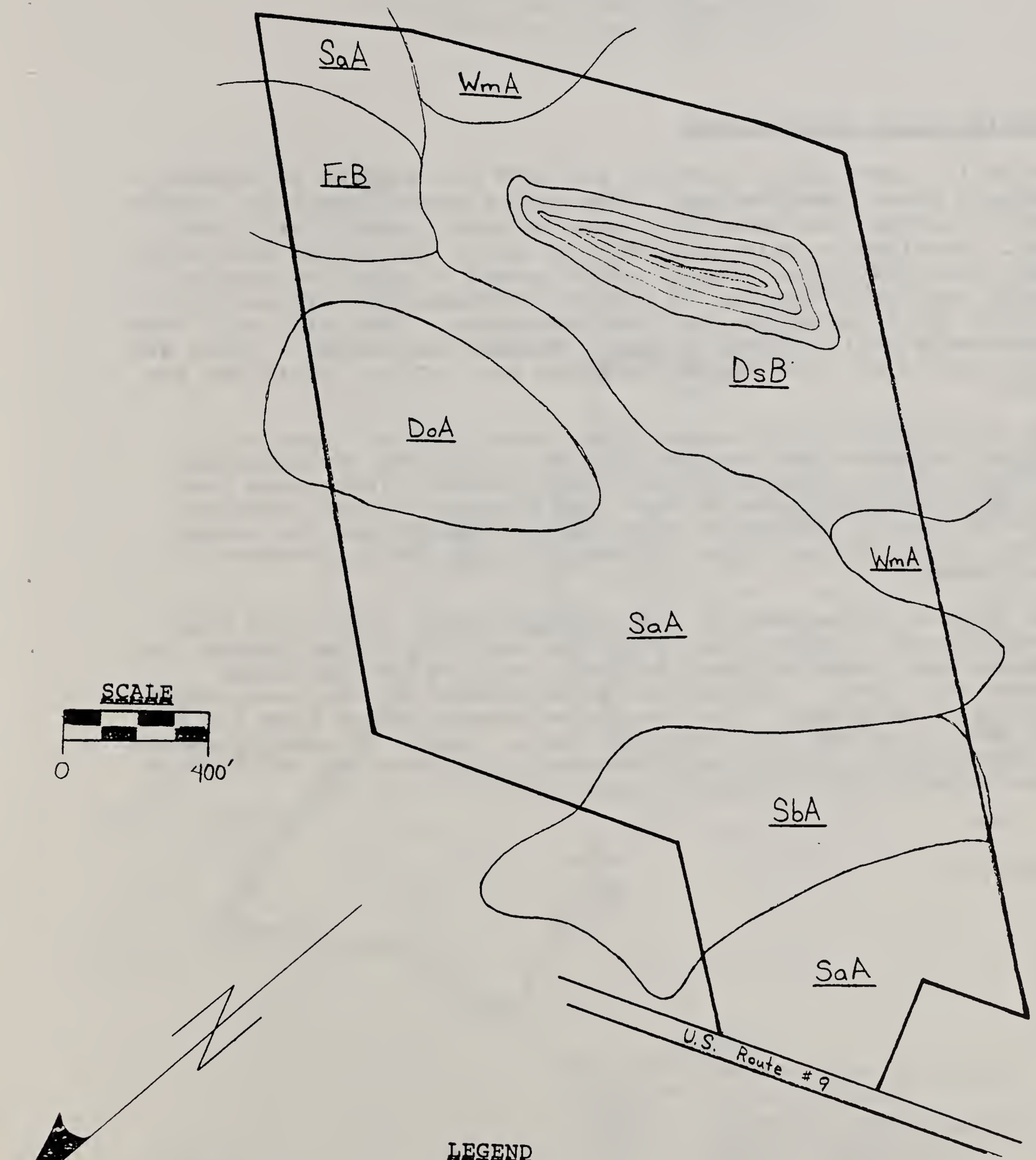




1990 PROPERTY & FIELD MAP
USDA - Soil Conservation Service
Cape May Plant Materials Center
Cape May Court House, NJ

CAPE MAY - PMC SOILS DELINEATIONS

USDA - Soil Conservation Service
Cape May Court House, NJ



LEGEND

DoA	Downer loamy sand, 0-3% slopes
DsB	Downer sandy loam, gravelly substratum, 0-5% slopes
FrB	Fort Mott sand, 0-5% slopes
SaA	Sassafras sandy loam, 0-2% slopes
SbA	Sassafras sandy loam, water table, 0-2% slopes
WmA	Woodstown sandy loam, 0-2% slopes
	Pond

Description of Service Area

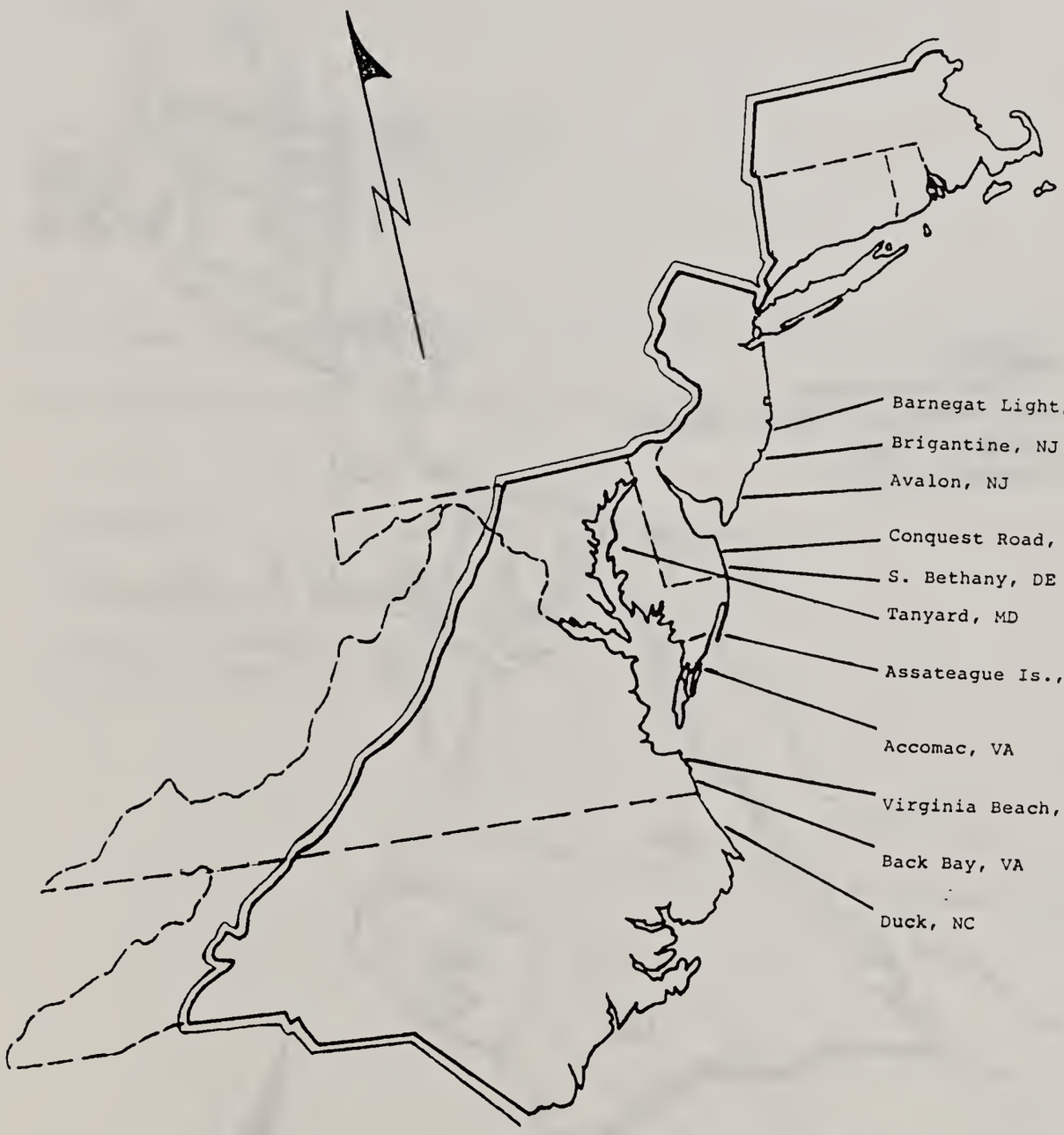
The soils, topography, climate, and land use combine to produce a distinct plant resource area. The soil-forming materials include glacial outwash and underlying beds of sand, gravel, silt, and clay. Problems in this area include active sand dunes that exist along the coast, wind erosion which occurs on sandy cultivated fields, and water erosion on sloping cropland, and stream bank erosion which threatens the tidal estuaries. The soils vary from excessively well drained to poorly drained and swampy. There are large tracts of tidal marsh bordering bays, river inlets and the ocean.

The topographic relief ranges from large areas of level or slightly sloping land to less extensive sections of moderately rolling ridges. The relatively level coastal plain rises from sea level to elevations of more than 600 feet in the piedmont. Level to gently undulating topography characterizes the coastal plain, while gentle slopes and steep ridges are predominant in the piedmont.

The climate is tempered by the Atlantic Ocean. There are wide fluctuations in annual precipitation, and to a lesser extent, in temperature. Drought years do occur and tropical hurricane storms are common. Mean annual precipitation in the area ranges from 38 to 46 inches. The frost-free season varies from 170 to 250 days, with the mean being 196 days. Length of growing season is affected by latitude and elevation. The Cape May PMC Service Area includes Plant Hardiness Zones 5-9.

OFF-CENTER PROJECT LOCATION

USDA - Soil Conservation Service
Cape May Plant Materials Center
Cape May Court House, NJ



SCALE

0 120 mi.

LEGEND

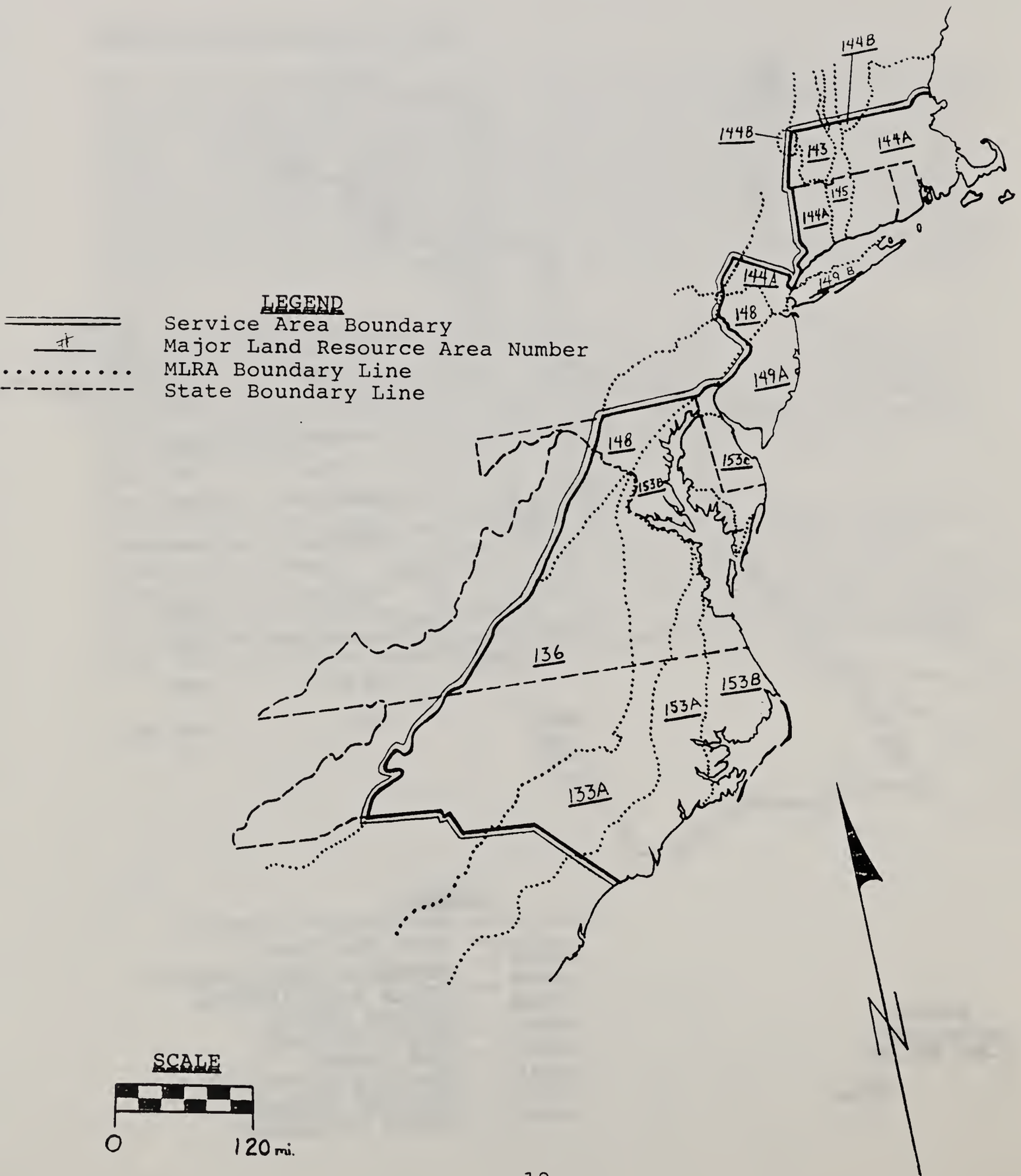
Service Area Boundary

State Boundary

*AMBR -- Ammophila breviligulata
*MYPE -- Myrica pensylvanica
*PAAM -- Panicum amarum
*PRMA -- Prunus maritima
*RORU -- Rosa rugosa
*SPAL -- Spartina alterniflora
*SPPA -- Spartina patens
*UNPA -- Uniola paniculata

SERVICE AREA MAP

USDA - Soil Conservation Service
Cape May Plant Materials Center
Cape May Court House, NJ



United States
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Cape May Plant Materials Center
1536 Route 9 N.
Cape May Court House, NJ 08210

August 13, 1991

U.S. Department of Agriculture
National Agricultural Library
Serials Branch, Room #002
Beltsville, MD 20705

Enclosed, please find your copy of the 1989-90 Annual Report

for the Cape May Plant Materials Center.

Sincerely,

Donald W Hamer

DONALD W. HAMER
Manager, Cape May PMC

enc.

25TH Anniversary Celebration/New Building

Ground Breaking Ceremony

Anniversary festivities were held October 24, 1990 to recognize the 25th year that the Cape May PMC has provided the northeast with its expertise. One-hundred and fifty people attended the ground breaking ceremonies for the addition to the existing office building and were provided a chicken barbeque for lunch. Barbara Osgood (NJ State Conservationist), Richard Duesterhaus (SCS-Assistant Chief), Curtis Sharp (SCS-NPMS), Don Hamer (Cape May PMC Manager), Art Brown (NJ Secretary of Agriculture), and Larry Newbold (Cape May County Agriculture Agent) gave a few words of history and insite about the Cape May PMC during lunch. All buildings were open for self-guided tours after lunch. Two inclusive field tours were also offered after the luncheon. The field tours allowed those attending a chance to see what projects are currently taking priority at the Cape May PMC.

WEATHER RECORDS AT CAPE MAY PLANT MATERIALS CENTER FOR 1989

1989 Month	Air Temperature °F						4" Soil Temperature °F						Precipitation			
	Maximum			Minimum			Maximum			Minimum			Total Inches	Deviation	Greatest Daily	No. Days
	Ext.	Av.	Deviation		Av.	Ext.	Ext.	Av.	Deviation		Av.	Ext.				
Jan.	62	47	+6	+7	30	14	41	38	-1	-3	34	31	2.30	-1.20	.59	10
Feb.	69	44	+2	+2	27	9	45	37	-2	-1	36	32	2.72	-0.45	.68	13
March	82	50	0	0	34	18	59	41	-6	-4	38	33	6.48	+2.96	1.27	14
April	78	62	+2	+0	41	26	58	53	-3	0	51	43	7.47	+3.87	3.13	11
May	86	70	+1	+1	52	40	68	61	-5	-6	54	53	3.48	-0.24	.95	13
June	93	82	+3	+7	67	52	82	75	-2	-1	70	65	5.68	+2.39	2.76	12
July	93	83	-1	+2	67	57	81	77	-5	-5	72	68	5.06	+2.30	2.24	9
Aug.	90	81	-2	+2	66	54	79	75	-6	-5	71	69	6.00	+1.99	2.24	16
Sept.	92	78	+1	+2	60	38	75	71	-4	-4	67	57	6.09	+3.35	2.13	9
Oct.	82	70	+4	+1	47	32	66	59	-6	-5	56	51	4.29	+0.89	1.18	8
Nov.	73	57	+3	-1	38	13	58	48	-6	-3	47	38	4.60	+0.98	1.26	8
Dec.	51	37	-9	-10	18	3	39	33	-10	-10	31	29	1.24	-2.38	.77	10
1989	93	64			46	03	82	56			52	29	55.41	+14.46	3.13	133
Normal*		63			45			60			56		41			

*Normal based on:

24 yr. Air Temperature Average; 20 yr. Soil Temperature Average; 24 yr. Precipitation Ave.

Frost free days 179 - April 14 to Oct. 10, 1989 - Normal 191 days.

19.0 inches of snow fell during the months of Jan., Feb., March, Nov. and December.

WEATHER RECORDS AT CAPE MAY PLANT MATERIALS CENTER FOR 1990

Month	Air Temperature °F					4" Soil Temperature °F					Precipitation			
	Maximum			Minimum		Maximum			Minimum		Total	Devi-	Greatest	No.
	Ext.	Av.	Deviation	Av.	Ext.	Ext.	Av.	Deviation	Av.	Ext.	Inches	ation	Daily	Days
Jan.	63	51	+10	+ 8	31	20	44	37	- 2	- 2	35	29	2.13	-1.30	.53	10
Feb.	70	53	+11	+ 1	26	10	49	43	+ 4	0	37	33	.61	-2.46	.27	9
March	81	56	+ 5	- 2	32	13	57	46	0	- 2	40	33	2.49	-0.98	.95	9
April	89	60	+ 3	- 2	43	28	66	53	- 3	- 3	47	42	4.01	+0.39	.80	12
May	83	68	- 1	0	51	40	69	63	- 3	- 2	58	55	6.06	+2.25	2.14	13
June	89	78	- 1	+ 1	61	46	78	71	- 5	- 6	65	57	1.90	-1.34	1.20	8
July	96	84	0	+ 2	68	54	82	75	- 7	- 4	73	68	2.47	-0.28	1.36	9
Aug.	96	82	- 1	+ 2	66	57	85	77	- 4	- 4	72	69	4.50	+0.47	.98	13
Sept.	90	75	+ 2	- 3	55	38	78	70	- 5	- 6	64	56	1.27	-1.41	.45	7
Oct.	83	71	+ 5	+ 4	50	29	74	68	+ 3	- 1	60	44	2.23	-1.13	.98	8
Nov.	77	59	+ 5	0	39	25	61	52	- 2	- 6	44	38	1.85	-1.70	.65	6
Dec.	69	53	+ 7	+ 5	34	18	51	44	0	- 4	37	33	3.54	-0.07	1.10	12
1990	96	66			46	10	85	58			53	29	33.06	-7.42	2.14	116
Normal*		63			45			60			56		41			

*Normal based on:

25 yr. Air Temperature Average; 21 yr. Soil Temperature Average; 25 yr. Precipitation Ave.

Frost free days 193 - April 19 to October 30, 1990. Normal 191 days.

1.2 inches of snow fell on March 25, 1990 for the only snow of the year.

WATER QUALITY PROJECTS

1. PLANT CHEMICAL RECLAMATION PROJECT

2. INITIAL EVALUATION OF SWEET VERNALGRASS (*ANTHOXANTHUM ODORATUM*)

SOIL CONSERVATION SERVICE
PLANT MATERIALS CENTER
CAPE MAY, NEW JERSEY

PMC PROJECT PLAN

I. Project Title: Plant Chemical Reclamation Project.

Project No: 34C137V

Preventing pollutants and nutrients from reaching the ground and surface water is a major step in improving water quality. Plant materials can be used to uptake these compounds. Vegetative filter strips are designed for this purpose and can be placed around areas that would receive an influx of nutrients and pollutants such as agricultural fields, feedlots, septic systems, streams and rivers.

II. Problem:

Nutrients in drinking water can be unhealthy for both humans and animals. Vegetative filter strips have been used in the past to utilize excess nutrients, but not enough information is known about the efficiency of the vegetation to use and hold nutrients, along with the response of the plants to seasonal variation. Also of importance are the physiological parameters such as: the rate of nutrient absorption in response to change in nutrient concentration; maximum absorption rate; minimum nutrient requirement; impact on hydrology through evapotranspiration; length of seasonal uptake activity; biomass production; and response to widely varying conditions such as wet soils and extended periods without receiving moisture.

III. Objective:

The objective of this project is to develop a plant materials list identifying the best possible plants for vegetative filter strip use under varying site conditions and management practices.

IV. Literature Review: Attachment I.

V. Procedure:

A. Assembly: 1990
1. Species:
a. *Anthoxanthum odoratum* sweet vernalgrass
b. *Bromus willdenowii* matua prairie bromegrass
c. *Dactylis glomerata* orchardgrass 'Comet'

		and 'Potomac'
d.	Festuca arundinacea	tall fescue 'Tribute'
e.	Lolium perenne	perennial ryegrass 'Repell'
f.	Panicum virgatum	switchgrass 'Cave-in-Rock' and 'Shelter'
g.	Phalaris arundinacea	reed canarygrass 'Palaton'
h.	Poa pratensis	Kentucky bluegrass 'Park'

2. Location: Above seed la, c (Comet), d, e and h will be obtained from the University of Rhode Island. Seed lb, c (Potomac) and f (Shelter) will be obtained from Big Flats Plant Materials Center. Cave-in-Rock switchgrass will be purchased from Bluestem Seed Company and Palaton reed canarygrass will be purchased from Loft's Seed Company.

B. Lysimeter Installation: 1990

1. Location: Cape May Plant Materials Center, southern end of Field 27.

2. Soil: Downer Loamy Sand.

3. Lysimeter Design: See Attachment II.

4. Lysimeter Placement:

Collection Assembly: Approximately 90 cm below surface soil in alleys between plots.

Ceramic Plate Moisture Sampler: Approximately 70 cm below undisturbed soil profile and approximately 100 cm from collection assembly. Exact depth will depend on soil horizons, rooting depths, pre-existing root channels and state soil zone. (See Attachment III).

5. Lysimeter Number: A total of 66 lysimeter units, placed three units per plot under 22 plots.

6. Installation Date: April, 1990.

C. Plot Establishment: 1990

1. Plot Size: 4.6m x 3.0m (15 ft. x 10 ft.) with 0.61m (2 ft.) grassed alleys between plots.

2. Plot Number: Total of 66; 22 per replication.

Twenty vegetation plots and two control plots (bare soil) per replication. See Attachment IV for plot layout.

3. Replication Number: (3) each accession and treatment is randomized.

4. Management Treatments: (2); FORAGE HARVEST and ONE CLIP.

5. Plot Preparation:

   a. Plow
   b. Disc harrow
   c. Spike tooth harrow
   d. Rake smooth
   e. Hand broadcast seed
   f. Rake in seed
   g. Rolled seedbed

6. Seeding Rates:

Accession	Grams per Plot (13.8 m)
Sweet vernalgrass	19.5
Matua prairiegrass	46.7
Comet orchardgrass	37.6
Potomac orchardgrass	37.6
Tribute tall fescue	46.7
Repell perennial ryegrass	46.7
Cave-in-Rock switchgrass	37.6
Shelter switchgrass	37.6
Palaton reed canarygrass	37.6
Park Kentucky bluegrass	37.6

7. Seeding Date: June, 1990.

8. Fertilization: None at time of establishment.

9. Weed Control: Herbicides and hand weeding as necessary.

10. Pest Control: None

11. Irrigation: To insure seedling establishment and survival.

D. Maintenance: 1990-1992

1. Reseed: As necessary.

   Warm season grasses - early May.
   Cool season grasses - early September.

2. Weed Control: As necessary by chemical, hoe and hand weeding.

   At time of first fertilization, apply herbicides to control annual grasses and broadleaf weeds on all plots.

   Vegetative Plots:

   Cool Season Grasses:

Broadleaf weeds:	Banvel + 2.4=D.
Annual Grasses:	Team.
Perennial Grasses:	Roundup (2%)
Yellow Nutsedge:	Basagran

   Warm Season Grasses:

Broadleaf weeds and annual ryegrass:	Atrazine
Perennial Grasses:	Roundup (2%)
Yellow Nutsedge:	Basagran

   Control Plots:

   All plots to receive Banvel + 2,4-D and Team to control broadleaf weeds and annual grasses. Control plots designated FORAGE HARVEST will receive minimal disturbance the rest of the growing season. Control plots designated ONE CLIP will be cultivated to a depth of 2.5 cm (one inch) once a month.

3. Insect Control: Only as needed and upon recommendation of URI.

4. Disease Control: Same as 3.

5. Irrigation: Applied only when transient wilting persists. Enough water will be applied to bring soil moisture level to 75-80% of field capacity.

6. Cutting Treatments: (2)

   a. ONE CLIP plots are clipped once during the summer. Forage is left on the plots.

   b. FORAGE HARVEST plots - Cool season and warm season plots will receive a first cut at initiation of flowering. The cool season plots will receive a second cut when the grasses are 23 cm (9 inches) tall and will be clipped to 8 cm (3 inches). The warm season grasses will receive a second cut when the grasses are 31 cm (12 inches) tall and will be clipped to 15 cm (6 inches). A third cut will take place at

initiation of flowering for both cool and warm season grasses. A final cut is made in the fall when top growth has ceased.

7. Fertility Treatments:

a. At spring green up 907 gm (2 lbs.) N/93 m (1000 sq. ft.) will be applied.

b. One week after the first cut, 454 gm (1 lb.) N/93 m will be applied.

c. One week after the second cut, 454 g N/93 m will be applied.

d. At cessation of top growth in the fall, 907 g N/ 93 m will be applied.

Note: Nitrogen will be in the form of urea. Application of phosphorus and potassium will depend on the soil test.

E. Sample Collection:

1. Water Sampling:

a. Apply pressure to the lysimeters at an amount slightly higher than the soil moisture tension at field capacity. Maintain pressure for 48 hours after precipitation has stopped.

b. To withdraw water samples, apply sufficient pressure to the lysimeter and evacuate the collection tube.

2. Soil Sampling:

Collect soil cores from each plot in the spring and fall of the year.

3. Plant Tissue Sampling:

Foliage tissue samples are collected from all plots at the time of forage cuts. The tissue is dried and ground.

Attachment I

LITERATURE REVIEW

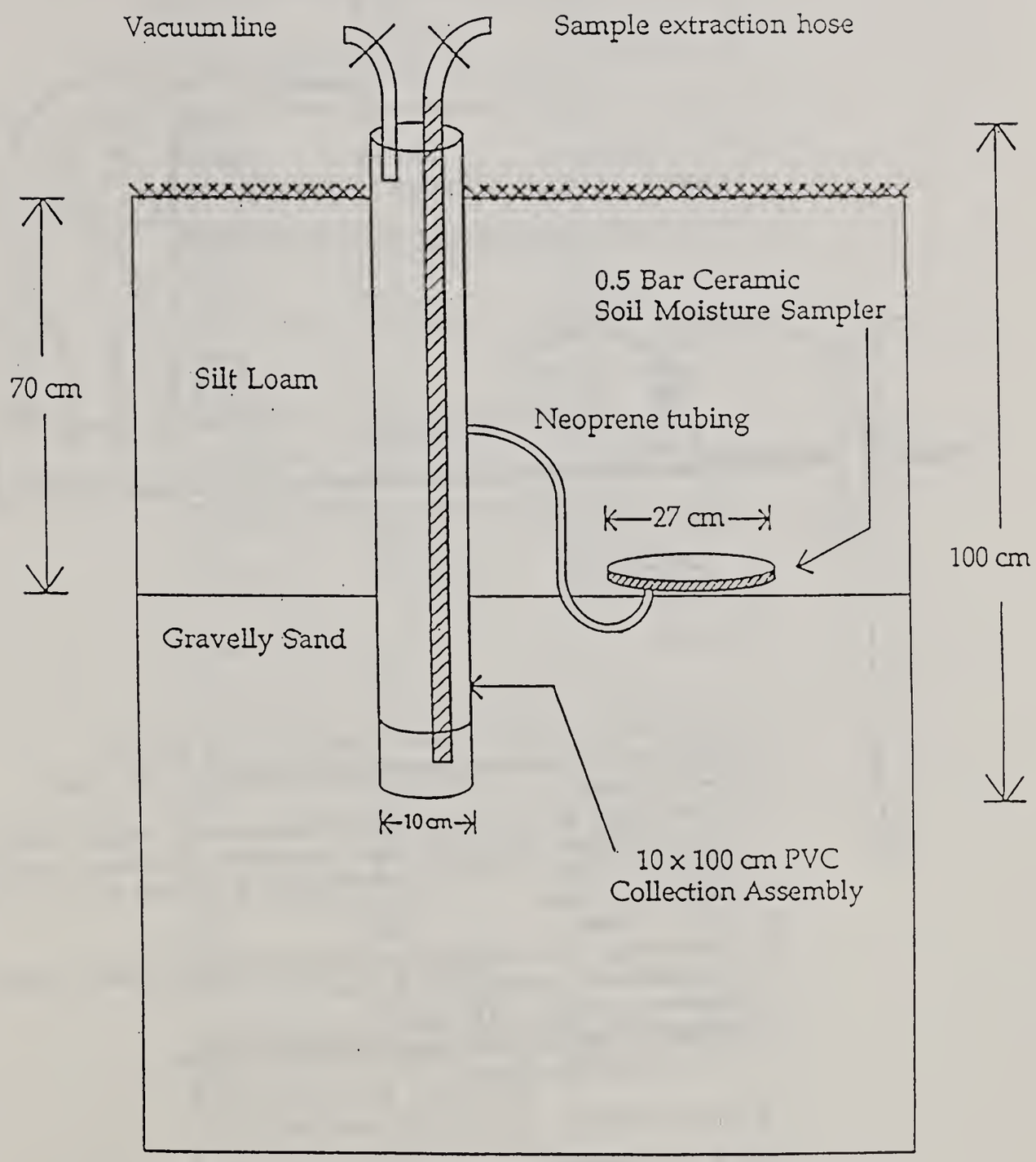
A literature review was performed by Dr. W. Michael Sullivan and Jerrell L. Lemunyon. Several of the important citations follow:

1. Dillaha, T. A., R. B. Reneau, S. Mostaghimi and D. Lee. 1989. Vegetative Filter Strip for Agricultural Nonpoint Source Pollution Control. Transactions of the ASAE 32(2): 513-519.

2. Gold, A. J., W. R. DeRagon, w. M. Sullivan and J. L. Lemunyon. 1990. Nitrate-nitrogen losses to groundwater from rural and suburban lead uses. J. Soil and Water Cons. 45(2): 305-310.

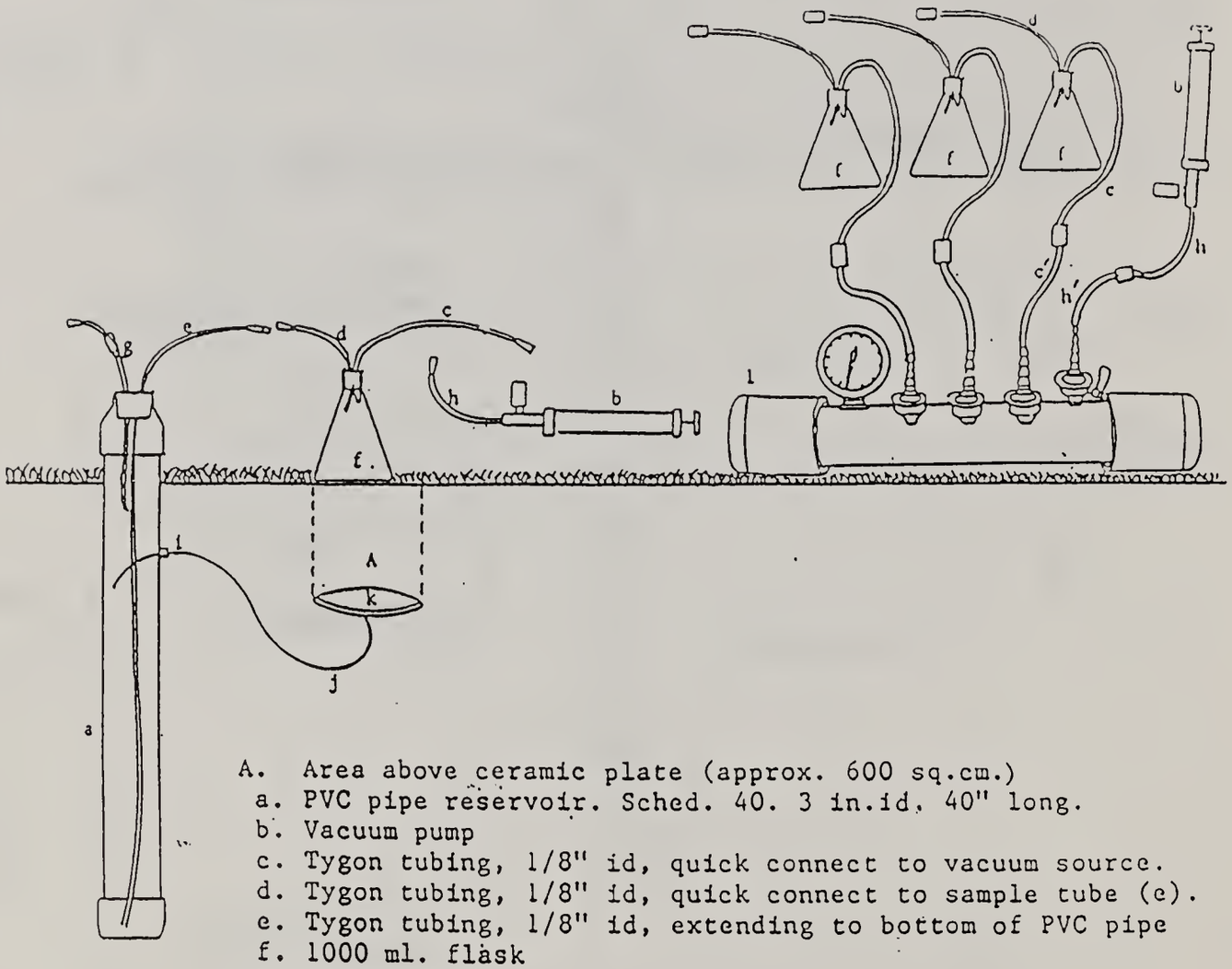
3. Morton, T. G., A. J. Gold and W. M. Sullivan. 1988. Influence of Overwatering and Fertilization on Nitrogen Losses from Home Lawns. J. Environ. Qual. 17(1): 124-130.

ATTACHMENT II



A suction-type lysimeter

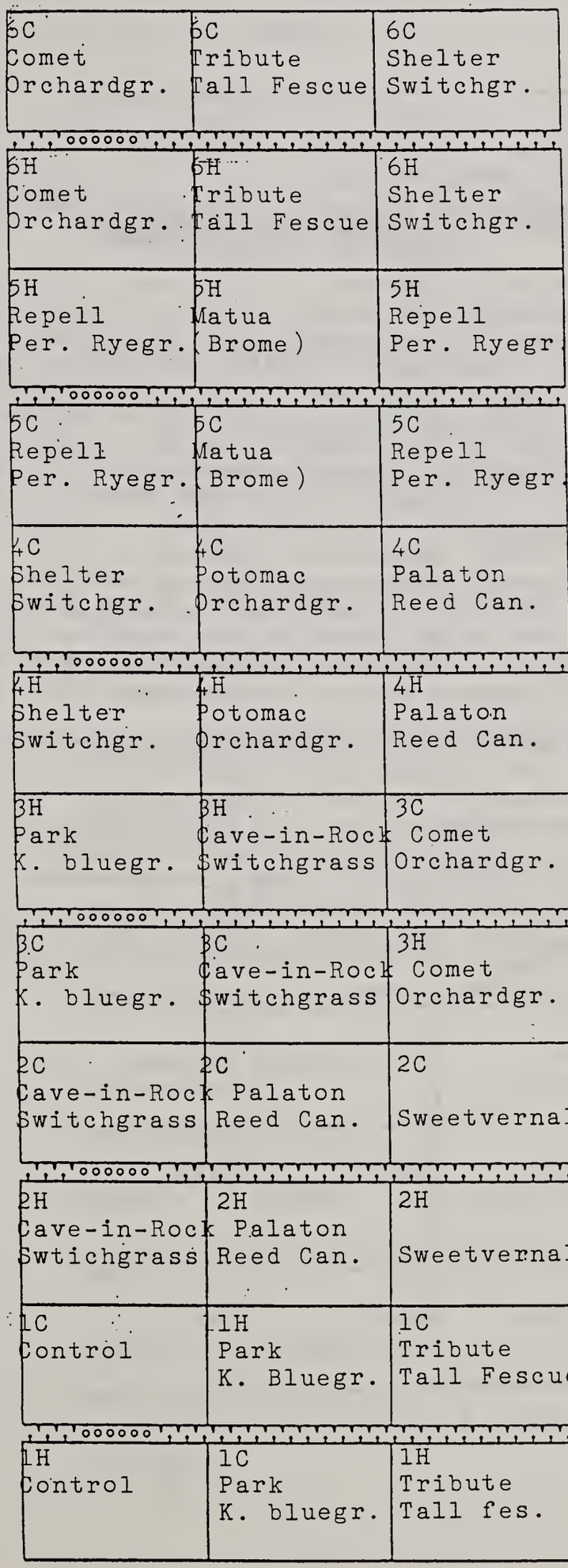
ATTACHMENT III



A. Area above ceramic plate (approx. 600 sq.cm.)
a. PVC pipe reservoir. Sched. 40. 3 in.id. 40" long.
b. Vacuum pump
c. Tygon tubing, 1/8" id, quick connect to vacuum source.
d. Tygon tubing, 1/8" id, quick connect to sample tube (e).
e. Tygon tubing, 1/8" id, extending to bottom of PVC pipe
f. 1000 ml. flask
g. Pinch clamp
h. Pump inlet tube. Tygon tubing 1/8" id. w/quick coupler.
i. Outflow tube assembly
j. Rubber tubing, 1/16" id.
k. Porous ceramic soil water sampling plate.
l. PVC vacuum manifold.

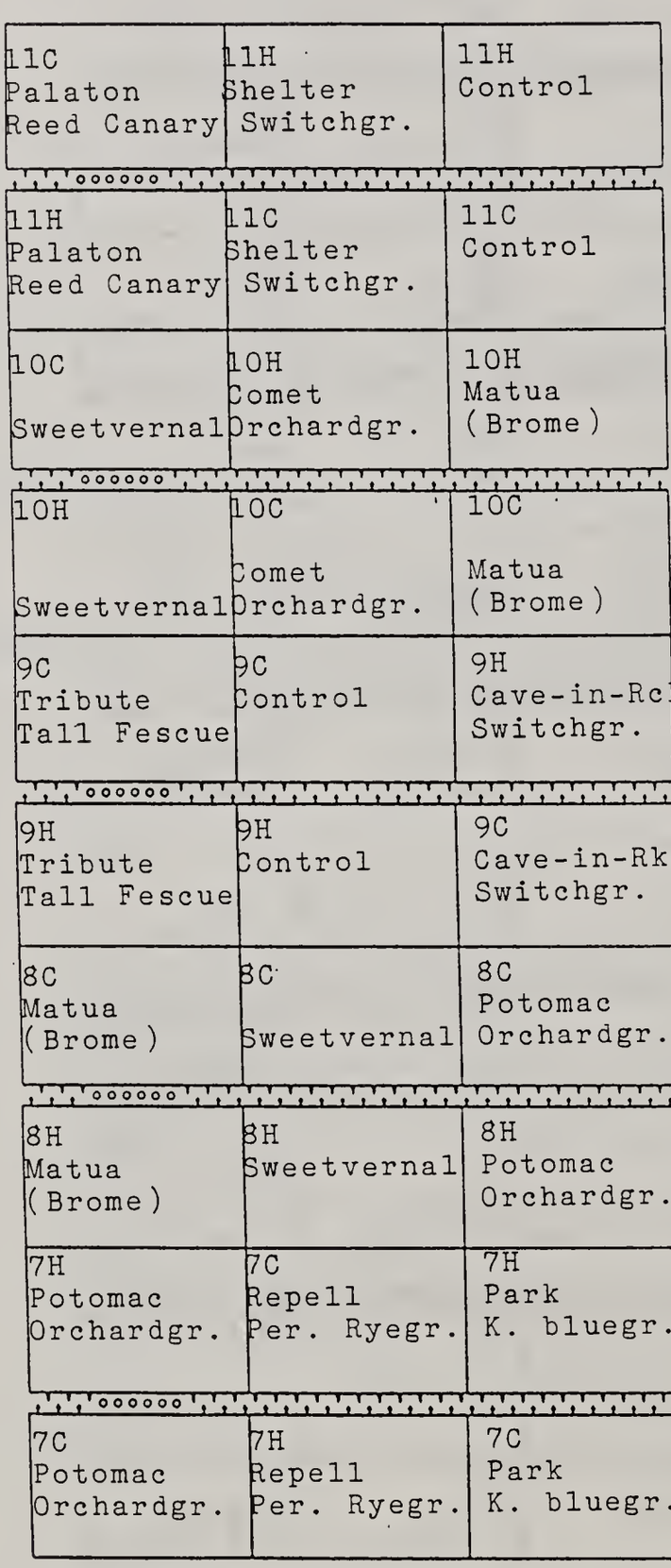
Plate lysimeter assembly and sampling apparatus

ATTACHMENT IV
Plant Chemical Reclamation Project, CM PMC F-27



Plant Chemical Reclamation Project, CM PMC F-27

To Woods



To Sheet 1

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INITIAL EVALUATION OF SWEET VERNALGRASS (*ANTHOXANTHUM ODORATUM*)

There is currently great emphasis throughout the nation for SCS to concentrate on improving and protecting the quality of ground and surface water resources. With the increased interest in water quality, agricultural fertilizers and animal waste have been identified as two of the major sources which degrade rural America's water supply. Since SCS has been delegated the responsibility to aid in improving water quality, the Plant Materials Program has been employed to develop plants which will uptake such pollutants. Sweet vernalgrass (*Anthoxanthum odoratum*) is one such grass which possesses the ability to uptake excessive amounts of nutrients. The objective of this initial evaluation of sweet vernalgrass is to identify and develop a superior cultivar for release, which can be utilized for vegetative strips or mats that filter-out water soluble pollutants before they contaminate ground or surface water.

An assembly of fifty-six accessions of sweet vernalgrass was randomly planted into Field 2 of the Cape May PMC in mid-September 1990. By October 9, 1990, all but five accessions had emerged. On November 11, 1990, all accessions which had emerged (51) were evaluated for survival, vigor, foliage abundance, cover,and relative rank. Sweet vernalgrass is a cool season grass and at the end of December 1990, there was a large portion of each plant which still possessed green foliage. This grass will continue to be evaluated until a superior cultivar is chosen.

1989 - 1990
SAND DUNE RESTORATION PROJECTS

1. INITIAL EVALUATION OF SEA OATS (*UNIOLA PANICULATA*)

2. WOODY PLANTS FOR SAND DUNE RESTORATION:
   a. ADVANCED EVALUATION OF BEACH PLUM (*PRUNUS MARITIMA*)
   b. ADVANCED EVALUATION OF BAYBERRY (*MYRICA PENSYLVANICA*)
   c. ADVANCED EVALUATION OF RUGOSA ROSE (*ROSA RUGOSA*)

3. EVALUATION OF AMERICAN BEACHGRASS (*AMMOPHILA BREVILIGULATA*) FOR LONGEVITY

4. EVALUATION OF BITTER PANICGRASS (*PANICUM AMARUM*) FOR SAND DUNE RESTORATION

5. EVALUATION OF SALTMEADOW CORDGRASS (*SPARTINA PATENS*) ON SAND DUNES

6. ADVANCED EVALUATION OF SEASIDE GOLDENROD (*SOLIDAGO SEMPERVIRENS*) FOR SAND DUNE RESTORATION

7. INITIAL EVALUATION OF NATIVE LEGUMES FOR SAND DUNE RESTORATION

INITIAL EVALUATION OF SEA OATS (UNIOLA PANICULATA)

Sea oats (Uniola paniculata) is a warm season, perennial bunchgrass that is the dominant native foredune species of the coastal strand environment extending from Northampton County, Virginia south to Florida and the Dry Tortugas in the Caribbean and west to Texas and the Gulf states of Mexico. In addition to being dominant on the frontal dune, sea oats occur through the back dune and rear depressed areas of the coastal ecosystem, where they are commonly found with bitter panicgrass (Panicum amarum) and saltmeadow cordgrass (Spartina patens).

Both the above and below ground portions of sea oats help to trap and accumulate sand, resulting in small dunelets forming around the plants. As both the number of sea oats and the number of dunelets increase, a barrier is created against storm-generated waves. In addition, the spread of the plants' extensive rhizome system helps to prevent the deflation of existing dunes.

Many authors have noted that diverse planting mixtures are preferable over monocultures for promoting stand longevity, pest resistance, and the ability to withstand environmental degredation. Sea oats is considered to be excellent for companion planting with American beachgrass (Ammophila breviligulata) and bitter panicgrass (Panicum amarum). As consequence of sea oats being a warm-season (C4) grass and American beachgrass being cool-season (C3), mixed plantings offer a maximum amount of yearly growth and, hence, sand-binding ability. Although the increased rate of tillering for American beachgrass allows for faster establishment, sea oats tends to outlive and take over beachgrass plantings over time. Sea oats tends to remain more vigorous than does American beachgrass under conditions of reduced fresh sand accumulation. In addition, sea oats has been noted as much more resistant to marasmius blight than is American beachgrass, bitter panicgrass, or coastal panicgrass.

The Cape May PMC began the evaluation of sea oats in 1982 with the dual objective of selecting an ecotype with cold-tolerance and selecting/breeding an ecotype with superior vigor. Currently, there are 47 accessions located in various evaluation sites in Virginia, Delaware, and New Jersey. Twenty five (25) accessions were chosen in 1990 for evaluation for increased cold-tolerance. A twenty-sixth accession was added to the previous 25 selections after being bred in a random pollination nursery composed of several of the most promising ecotypes. In June of 1990 the 25 accessions were planted in a replicated evaluation for Northern range at Barnegat Light, New Jersey. A second replicated planting including all 26 potential cold-tolerant ecotypes will be placed on Island Beach State Park in Ocean County, New Jersey during June of 1991.

Sixteen (16) ecotypes were chosen in 1990 for continued evaluation for superior vigor. Interestingly, all but six of the sixteen accessions were previously chosen for inclusion in the evaluation for Northern range. The sixteen ecotypes with potentially superior vigor will be planted in June of 1991 in a replicated planting located in Delaware.

1.) Compare the transplant survival of potted stock with that of bare-root stock; and

2.) Compare the resultant vigor, foliage production, and dormancy tendencies of establishment with 30 gm. per hill of 19-6-12 slow-release osmocote as compared to broadcast with 500 lb. per acre of 10-10-10 fertilizer.

Sea Oat Accessions Included in the CM PMC Initial Evaluation for Northern Range and Superior Vigor

Original Acc. No. [1/]	1/2-sib Progeny No. [2/]	Original Collection Site	Included in Cold-Tolerance Evaluation [3/]	Included in Superior Vigor Evaluation [4/]
9027034	9061156	Back Bay, VA	yes	yes
9027035	9061157	VA Beach, VA	yes	yes
9027036	9061158	VA Beach, VA	no	yes
9030194	9061159	Cape Charles, VA	yes	yes
9030195	9061160	Accomack, VA	no	yes
9030199	9061163	VA Beach, VA	yes	no
9030201	9061165	VA Beach, VA	no	yes
9030203	9061167	VA Beach, VA	yes	no
9039013	9061168	Northampton, VA	yes	yes
9039031	9061169	Carteret, NC	yes	yes
9039033	9061202	Georgetown, SC	yes	yes
9039034	9061170	Georgetown, SC	yes	no
9039036	9061171	Georgetown, SC	no	yes
9039037	9061172	Georgetown, SC	no	yes
9041959	9061173	Charlestown, SC	yes	yes
9041960	9061243	Charlestown, SC	no	yes
9041961	9061174	Dare, NC	yes	no
9041969	9061203	Currituck, NC	yes	yes
9041970	9061175	Dare, NC	yes	no
9041971	9061176	Dare, NC	yes	no
9041972	9061177	Dare, NC	yes	no
9041973	9061178	Dare, NC	yes	no
9041974	9061179	Dare, NC	yes	no
9041975	9061180	Dare, NC	yes	no
9041976	9061181	VA Beach, VA	yes	yes
9041977	9061182	VA Beach, VA	yes	no
9041979	9061184	VA Beach, VA	yes	no
9041981	9061186	VA Beach, VA	yes	yes
9041983	9061188	VA Beach, VA	yes	no
9041984	9061189	VA Beach, VA	yes	no
9041985	9061190	VA Beach, VA	yes	no
9061242	-------	CM PMC Random-X Cape May, NJ	yes	no

1/ Represents the accession number assigned to ecotype at the time of initial collection.

2/ Represents the accession number assigned to 1/2-sib progeny from the original ecotype.

3/ Evaluation for cold-tolerance includes 26 accessions total.

4/ Evaluation for superior vigor includes 16 accessions total.

WOODY PLANTS FOR SAND DUNE RESTORATION

In the mid '60's, when the Cape May Plant Materials Center was established, great emphasis was placed on controlling coastal beach erosion. A major achievement of that time period was the development of 'Cape' American beachgrass (Ammophila breviligulata). This grass is a pioneer species but acclimated to shifting frontal dunes. The large expanse of secondary sand dunes has since been identified as the vegetative zone which is capable of withstanding powerful wave action, providing the last protective barrier to population centers. This backdune zone is predominantly stocked with shrub and small tree species.

Assemblies of the most common shrubs and trees, native to sand dunes of MLRA 149 and 153 were organized in 1979. Three of those woody dune plants are still being evaluated for use in stabilizing the backdune area. These species are beach plum (Prunus maritima), rugosa rose (Rosa rugosa) and bayberry (Myrica pensylvanica). All three species are currently being evaluated for survival, vigor, foliage abundance, insect and disease resistance, fruit production, and plant dimensions. The intent of such evaluations is to develop a superior cultivar for each species which would be released onto the commercial market. These woody releases will add to the diversity of the list of plants used to combat beach erosion.

In the spring of 1989 and 1990, one and two plantings of beach plum were respectfully installed in Delaware and New Jersey. All three plantings were comprised of the same four accessions remaining in the assembly. The addition of these plantings increases the number of active evaluation sites to nine located from North Carolina to Maine. Observing the four accessions of beach plum, 9011251 has the best average survival rate, vigor, plant dimensions, foliage abundance, disease resistance, and fruit production. Although this accession performs better, the margin by which it does, is not great enough to substantiate eliminating the remaining three accessions from the study. Current intentions are to continue observing and comparing the four accessions through the advanced evaluation period, then consider the evaluation and release of a random cross of all four accessions.

Seed from rugosa rose (9051590) on the other hand, has been the product of a polycross nursery at the Cape May PMC for the last four years. In the spring of 1990, an off-center planting was installed at Brigantine Beach in New Jersey. This planting employs two replications comparing seedlings of 9051590 to a commercially produced variety. The parameters evaluated in this comparison include number surviving, vigor, foliage abundance, insect and disease injury, and plant dimensions; all of which 9051590 received a higher rating.

The first off-center planting of bayberry was installed at Brigantine Beach in New Jersey during the spring of 1990. The plants installed at this site were 2/0 seedlings which were between 12 and 18 inches tall. There were four accessions used in this study; ten plants from each were planted with the exception of 9002768 which had only three plants installed. Accession 9002768 was rated the best and had the highest percent survival at 67%. Another planting of bayberry will be planted in 1991 incorporating replications in the study at a similar site.

EVALUATION OF AMERICAN BEACHGRASS (*AMMOPHILA BREVILIGULATA*) FOR LONGEVITY

American beachgrass (*Ammophila breviligulata*) is the dominant foredune plant from Virginia north to Nova Scotia. In addition, American beachgrass is also the species used most for the initial stabilization of the frontal dune portion of the Mid-Atlantic coast. Released from the Cape May PMC in 1972, the cultivar 'Cape' is considered to be superior for restoration use north of the Chesapeake Bay. However, Cape and other commercial varieties of beachgrass have exhibited a decline in vigor and eventual die-out in some sites despite proper management. The decline and subsequent die-off have been attributed to both insect and disease, but the exact cause of the problem has yet to be determined. As such, the purpose of this project is to compare Cape against other accessions of American beachgrass to note their relative longevity and growth form. It is hoped, that from this comparison, an ecotype can be found or bred that exhibits greater longevity and retains the superior vigor and growth attributes associated with Cape.

Seven (7) accessions are currently involved in the evaluation, including the cultivars Cape, 'Hatteras', and 'Bogue' as well as accessions 9047071, 9047072, 9047073, and 9047085. Hatteras, Bogue, 9047071, and 9047072 originated from the Carolinas, while 9047073 and 9047085 were collected from sites in Virginia Beach, Virginia. Cape American beachgrass was collected in 1965 from Barnstable County, Massachusetts. Active plantings currently include off-center sites at Duck, North Carolina; Fort Story Army Base in Virginia Beach, Virginia; Back Bay Wildlife Refuge in Sandbridge, Virginia; Brigantine, New Jersey; and Barnegat Light, New Jersey. In addition, the following plantings were established in 1990 on the Cape May PMC:

1.) A replicated comparison of the included accessions for longevity; and

2.) A random crossing block for the development of an additional accession with the potential for increased longevity.

To date, our initial observations suggest that although Cape American beachgrass has an extremely rapid rate of establishment, several of the recent collections may have a greater longevity and/or disease resistance. Two accessions, 9047072 and 9047073, appear to be amongst the most promising.

EVALUATION OF BITTER PANICGRASS (*PANICUM AMARUM*) FOR SAND DUNE RESTORATION

Recognizing the longevity problem found in stands of American beachgrass (*Ammophila breviligulata*), the staff of the Cape May PMC began searching for native grasses which grow in association with American beachgrass. In 1983, an assembly of bitter panicgrass (*Panicum amarum*) was made to test its performance on sites where American beachgrass had died out. Bitter panicgrass is a perennial warm season grass that is ideal for complimenting the cool season character of American beachgrass. This vegetatively established dune grass has semi-prostrate growth form and spreads by means of rhizomes; it has excellent sand stabilizing properties. The primary objective of this study is to identify a superior accession of bitter panicgrass that is adapted to the coastal sand dunes of the northeastern and southern United States.

Since the initiation of an assembly in 1983, the number of accessions has dropped from 57 to 3. In current evaluations, the cultivar 'Ocracoke' is used as the commercial standard for comparison. The accessions 515948, 518820, 518821 and Ocracoke are currently being increased at the Cape May PMC for off-center trials. These accessions are currently being evaluated by the area Plant Materials Specialists and the PMC Staff at several off-center locations.

One off-center planting is located at Brigantine Beach, New Jersey. This planting is comprised of two replications of the three accessions under evaluation as well as Ocracoke. This site is a beach front area which is periodically flooded by the high tides. Standing water has been observed in this planting after such flood events. The initial evaluation results reflect the known fact that bitter panicgrass does not tolerate wet soil conditions. High mortality was found where water had ponded for more than 24 hours.

EVALUATION OF SALTMEADOW CORDGRASS (*SPARTINA PATENS*) FOR DUNE RESTORATION

The detection of decline in the health of American beachgrass (*Ammophila breviligulata*) stands on coastal sand dunes has prompted the realization that pure stands of American beachgrass are not safe from an erosion protection stand-point. A complex of associated herbaceous dune species would be preferred. Such combinations would provide continuous stabilization in the event that pathogens were to reduce or eliminate the effectiveness of one species. The success of saltmeadow cordgrass (*Spartina patens*), as part of such a complex, is being evaluated at one site in New Jersey. It is hoped that this native of the backdune area can survive on the shifting sands of the foredune. This species of cordgrass is very salt tolerant.

At Brigantine Beach, New Jersey, a planting of saltmeadow cordgrass was installed in mid-April, 1990. It was located approximately 150 feet from the surf on a level area of the beach. On the nearby dunes, the predominant native species was American beachgrass. This planting consisted of two replications of 72 saltmeadow cordgrass plants which were surrounded by two border rows of American beachgrass. The last evaluation performed on this planting in 1990 yielded an average rate of 83 percent survival and a moderate rating for foliage production. The survival rate has been affected by abnormally high tides but due to moderate sand accumulation, this tide problem should not threaten the planting further.

ADVANCED EVALUATION OF SEASIDE GOLDENROD (*SOLIDAGO SEMPERVIRENS*) FOR SAND DUNE RESTORATION

Seaside goldenrod (*Solidago sempervirens*), a native perennial forb of the Mid-Atlantic region, has been evaluated for eight years. The number of accessions during that time period has been reduced to seven from seventy-nine. This forb is adaptive to both the fore and backdune area of the natural dune ecology. Seaside goldenrod has been observed to grow well in areas where American beachgrass (*Ammophila breviligulata*) is displaying signs of decline. Realizing the fact that such decline in American beachgrass is common to the Mid-Atlantic region, seaside goldenrod is being considered for inter-planting with American beachgrass to provide continuous vegetative cover particularly in the back dune area. Although seaside goldenrod is unbranched, it still provides acceptable erosion protection to stabilize these beach sites. It is the Cape May PMC's objective to select and develop a superior variety of seaside goldenrod to compliment American beachgrass in stabilizing the sand dunes.

In the spring of 1989, the seven remaining accessions in the study were transplanted into Feld 9 of the Cape May PMC with varying success. As of 1990, there were three accessions displaying the desired growth form for dune stabilization. The four other accessions do not show as much promise due to poor survival and other growth characteristics. Seed was collected from all seven accessions in 1989; but in 1990, 9027044 failed to yield seed. In the spring of 1991, the first off-center planting involving all seven accessions of seaside goldenrod is scheduled along the New Jersey coastline in a backdune site.

INITIAL EVALUATION OF NATIVE LEGUMES FOR SAND DUNE RESTORATION

Tissue-damaging salt spray, sand accumulation, and general nutrient deficiency are considered to be the primary limiting factors for the vegetative restoration of sand dunes. The use of salt-tolerant nitrogen converting species for co-planting with other dune flora has been recommended by many authorities on the strand environment. If proven effective, nitrogen-fixing forbs present an economical means of revegetating denuded dune areas.

Trailing wild bean (Strophostyles helvola) is a prostrate, herbaceous annual legume that can be found on well-drained, sandy soils from Quebec south to Florida and west to Ontario, South Dakota, and Texas. In the strand environment, trailing wild bean commonly occurs from the crest to the back portion of the foredune.

As with most legumes, trailing wild bean has root nodules which contain symbiotic bacteria which reduce atmospheric nitrogen to soluble nitrate. In addition, the plant has been shown to have amongst the highest net photosynthetic carbon dioxide assimilation levels noted for a C3 dicot. It is thought that its capability for abnormally high rates of photosynthesis is derived from trailing wildbean's heliotropic characteristics.

In order to compare the relative performance of trailing wild bean ecotypes, 39 accessions were increased and evaluated by the PMC during the 1989 growing season. Although a great deal of variance in color and growth form was noted, almost all accessions were extremely vigorous and produced prolific seed. However, there was a great deal of variance in the timing and duration of pod production. The southern ecotypes, as a whole, produced fruit much later in the season than did the northern types. As result, the southern accessions had a greater amount of foliage and less seed due to the onset of cold, moist fall conditions before the completion of pod maturation.

1989-90 COVER CROP PROJECTS

1. ADVANCED EVALUATION OF WINTER COVER CROPS

2. EVALUATION OF 'SYN-T' RYE AS WINTER COVER

3. INITIAL EVALUATION OF EASTERN GAMAGRASS (TRIPSACUM DACTYLOIDES)

4. INITIAL EVALUATION OF SAINFOIN (ONOBRYCHIS VICIAFOLIA)

ADVANCED EVALUATION OF WINTER COVER CROPS

On soils that are exposed for periods of one to twelve months, it is advisable to plant temporary vegetative cover. This serves as a protective measure to control erosion from wind or rain, runoff or snow melt and controls sedimentation. For these reasons, it is desirable to use cover crops on agricultural fields where bare soil is exposed. In 1983, the Cape May PMC became interested in identifying and releasing one or more winter cover crop species. The cover crop species would be used on conventionally tilled soybean and corn fields as well as on other land used to grow speciality crops such as tobacco, peanuts and vegetables. There are several ways to seed cover crops. They can be seeded after the main crop harvest, but it is difficult to get good stand establishment following late harvested crops. An alternative is to overseed into standing crops, providing the cover crop does not interfere with harvest operations. This seeding method will allow the cover crop to achieve sufficient growth before cold temperatures.

The initial screening in 1983 contained 1,200 accessions of annual grasses, legumes and forbs collected from a wide range of areas. By 1987, the accessions were reduced to ten. The most promising cover crop species included three bromegrasses (Bromus), one ryegrass (Lolium), two brassicas (Brassica) and one annual fescue (Vulpia). A decision was made to bulk several of the accessions of four species. Clean seed from the top five accessions of field brome (Bromus arvensis) was bulked in equal amounts and assigned a new accession number. This also took place for B. ciliatus and downy chess (B. tectorum), although the latter was a bulk of four accessions. In addition, annual ryegrass (Lolium perenne multiflorum) was also bulked from the best four accessions.

On September 16, 1988, an initial increase was planted for field brome, downy chess, brassica, Chinese cabbage and annual ryegrass. The six species were planted in rows totaling 240 feet per species. The annual fescue species did not need to be increased, therefore was not included in the 1988 planting. During June and July, 1989 the rows were harvested. Brassica produced 5.7 lbs. of seed while Chinese cabbage produced 1.7 lbs. of seed. This was attributed to scouring by birds of the Chinese cabbage which was located in a distant, isolated field. Brassica has an indeterminate growth habit and needed to be harvested several times. Comparing the yields of the bromegrass species, downy chess produced the greatest amount of seed, 17.8 lbs, and has shown in the past to be the most prolific of the bromegrasses. B. ciliatus and field brome produced 13.4 and 8.0 lbs., respectively. Annual ryegrass produced 4.0 lbs. of seed. It was observed that annual ryegrass experiences seed shatter while bromegrasses tend to hold onto their seed.

The 1989 cover crop planting included three planting dates, September 15, October 13 and 27. This was carried out to determine the latest possible date that will give an acceptable ground cover of these species. Ten accessions were planted and include the six species from the initial increase, two accessions of rattail fescue (V. myuros), 'Aroostook' and 'Syn-T' cereal rye (Secale cereale). These were planted into 6 x 10 foot replicated plots. A preplant 10-10-10 fertilzer was applied at a rate of 500 lbs/A. By February 8, 1990, the average ground cover of the species ranged from 65 to 98% for the September 25 planting, 5 to 50% for the October 13 planting and 2 to 30% for the October 27 planting. The top three accessions for gound cover production at all three planting dates were field brome, annual ryegrass and cereal rye.

In 1990, the ten accessions were planted on September 5 and 26 and October 16. By February 22, 1991, the average ground cover of the species ranged from 77 to 100% for the September 5 planting, 37 to 97% for the September 26 planting and 23-90% for the October 16 planting. Annual ryegrass was among the top accessions for ground cover production as it was in 1990. Another excellent accession was 'Syn-T' cereal rye. 'Aroostook' cereal rye was similar to 'Syn-T' for the first two planting dates in terms of ground cover but lagged behind for the third planting date. Two of the bromegrasses, field brome and downy chess, had almost complete ground cover for the first two planting dates but only showed 37 and 35% ground cover for the October 16 planting date, respectively. Two interesting accessions, Chinese cabbage and Brassica sp. maintained nearly the same percent ground cover for each planting date. Another curious observation is that the plants in the later two planting dates had a higher resistance to the cold than the plants planted on September 5. Perhaps, the plants from the latter two plantings had not obtained sufficient height thereby escaping the effects of cold winds. Another consequence of short stature is the proximity to the ground and the heat from solar radiance.

Further testing of these ten accesisons will be carried out during the fall of 1991.

EVALUATION OF 'SYN-T' RYE AS WINTER COVER

The late harvest of many Northeastern crops prevents the timely establishment of adequate winter field cover. As consequence, conventional cover crops are unable to make enough growth to provide adequate winter soil protection. Thus, the continued evaluation of potentially useful cultivars is of great importance.

Cereal rye (Secale cereale) is a winter annual grass commonly used for small grain and erosion control on cropland in the mid-Atlantic region. 'Aroostook' cereal rye was released in 1981 by the Big Flats PMC. Despite Aroostook's superior performance over commercially available rye types, there continues to be a need for additional varieties for seeding in late fall. Preliminary testing of 'Syn-T' at the Cape May PMC have shown potential for this cultivar to be used for late cover establishment.

An intensive planting date and planting rate evaluation for Syn-T versus Aroostook cereal rye was carried out by the PMC over the 1989-90 winter season. September 25, October 17, and November 6 planting dates and 2.0, 2.5 bushels per acre planting rates were used. The study also included a commercially available rye variety for the purpose of comparison. Evaluation was based upon the rate of establishment, percent cover, vigor, plant height, plant spread, and root growth.

In conclusion for the 1989-90 season, despite the fact that Syn-T produced somewhat more vigorous initial growth than either Aroostook or the commercial rye variety, it appeared to be significantly less cold tolerant. Extreme cold or snow cover caused the Syn-T plots to show widespread browning of the leaf tips and a general decline in vigor in comparison to the other varieties. In addition, the advent of warm spring temperatures caused Syn-T to grow taller and more "leggy", while the Aroostook and commercial varieties tended to produce more lateral growth. Only the Sept. 25 2.0 and 2.5 bu/A and Oct. 17 Syn-T and Aroostook plantings provided adequate ground coverage. Both varieties provided better coverage for all planting dates than did the commercial type.

For the 1990-91 season several changes were made for the project. The most significant of these changes was that all plots were planted according to Percent Live Seed (PLS) rates. The planting dates were changed to September 13 for the first planting, October 1 for the second planting, and October 22 for the third planting. In addition, to examine for any decline in seed vigor, the 1989 Cape May PMC produced Syn-T, which was used for both the 1989-90 and 1990-91 evaluations, was planted in a rod-row for comparison to a rod-row of the original 1987 Syn-T seed from Florida. Both rod-rows were planted according to PLS rates.

To date, Syn-T has been demonstrating distinct superiority for all three planting dates for the 1990-91 evaluation. However, the superiority of Syn-T over the commercial and Aroostook varieties is considered to be a product of the unseasonably warm temperatures being experienced by the PMC for the current winter. The advent of cooler temperatures is expected to produce similar results to those noted for the 1989-90 evaluation. Thus far, no decline in seed vigor has been detectable for the rod-row comparison.

'SYN-T' RYE FIELD PLANTING REPORT
(as submitted by USDA-SCS Plant Materials Specialist, PA)

The Cape May, New Jersey Plant Materials Center has been evaluating 'Syn-T' cereal rye in the search for a cover crop that will grow rapidly in the early fall. Syn-T is a synthetic cross from Florida that had survived winters at Cape May for several years and had exhibited good early fall growth. It had performed better than 'Aroostook', a SCS cultivar from Big Flats, New York, developed to germinate well in cold temperatures and grow well in the spring for green manure.

We have been evaluating Syn-T against Aroostook in field plantings for two years. In 1988-89, three plantings were evaluated: one each in New York, Pennsylvania, and Maryland. In 1989-90, six plantings were evaluated: five in Pennsylvania and one in West Virginia.

Generally, Syn-T has germinated well and has been taller and had more stems per unit area than Aroostook until December or January. After that period, Aroostook exhibited its advantage in spring growth. Syn-T had a lighter color and coarser leaves (1.5 centimeters vs. 1.0 centimeter) than Aroostook. It also turned brown after December and January and lost it's advantage in stems per unit area after that period.

Early May, green manure yields favor Aroostook in six out of the nine plantings. The advantage ranges from 384 to 288 pounds per acre to 7,405 to 4,066 pounds per acre. Two plantings in 1989-1990 on shaly soil favored Syn-T: 5,280 to 3,456 pounds per acre and 3,264 to 2,016 pounds per acre. One planting was even at 6,534 pounds per acre a piece.

It would seem that Syn-T does have a place as a cover crop where early germination and growth are important for erosion control or nutrient uptake. This would be especially appropriate following silage corn where residual nitrogen may be present or manure application after silage removal is planned. Although it performed better than Aroostook in the fall for all seeding dates except November 3, it would also seem that the earlier the seeding, the greater the advantage over Aroostook in the fall. Seeding aerially in August into a standing crop or by ground equipment before October 1 would demonstrate its best advantage over Aroostook.

In much of Pennsylvania, silage corn is managed poorly and not chopped anytime close to the September 1 optimum date, and often after October 1. This mismanagement will not lend itself to the best utilization of Syn-T even if it was seeded aerially. On the other hand, the good performance of Syn-T on shallow shaly soils may demonstrate it's superior drought tolerance over Aroostook which would make make it better adapted on much of Pennsylvania's soils.

1988-1989

Location	Cultivars	Dry Yield
Chemung County, NY MLRA 140	Aroostook Syn-T	1,991 #/acre 1,067 #/acre
Susquenhanna County, PA MLRA 140 Seeded 9/14/88	Aroostook Syn-T	6,534 #/acre 6,534 #/acre
Prince Georges County, MD MLRA 148	Aroostook Syn-T	7,405 #/acre 4,066 #/acre

1988-1989

Location	Cultivars	Dry Yield
Chemung County, NY MLRA 140	Aroostook Syn-T	1,991 #/acre 1,067 #/acre
Susquenhanna County, PA MLRA 140 Seeded 9/14/88	Aroostook Syn-T	6,534 #/acre 6,534 #/acre
Prince Georges County, MD MLRA 148	Aroostook Syn-T	7,405 #/acre 4,066 #/acre

1989-1990

Susquehanna County, PA MLRA 140	Aroostook Syn-T	384 #/acre 288 #/acre
Sesquehanna County, PA MLRA 140	Aroostook Syn-T	1,536 #/acre 768 #/acre
Perry County, PA MLRA 147	Aroostook Syn-T	7,200 #/acre 4,416 #/acre
Cumberland County, PA MLRA 147 (Bloserville)	Syn-T Common Aroostook	3,264 #/acre 3,072 #/acre 2,016 #/acre
Cumberland County, PA MLRA 147 (Newville)	Syn-T Aroostook	5,280 #/acre 3,456 #/acre
Jefferson County, WV MLRA 147 Seeded 11/3/89	Aroostook Syn-T Common	5,280 #/acre 3,648 #/acre 2,208 #/acre

Evaluation of Syn-T vs Aroostook Rye
Big Flat Plant Materials Center, Big Flats, NY

Seeded on 9/9/88 with 2.8 lbs. per plot in Block 1 Demo Nursery, broadcast by hand into harrowed field and cultipacked.

Date	Aroostook	Syn-T
9/9/88	Seeded	Seeded
9/16/88	Good germination 1-1/2" high.	Good germination 1-1/2" high.
9/22/88	Ht. 5" (3 leaf).	Ht. 5-1/2" (3 leaf).
10/31/88	Ht. 8" to the top of the stand. 14" leaf length on average.	Ht. 8" to the top stand. 15" leaf length on average.
	Visually - both look the same in height, thickness of stand, percent cover, vigor, green-ness of leaves. Only noticeable thing is some of the leaves of Syn-T are 30% wider than Aroostook.	
11/15/88	Ht. 9" to top of stand. 15" leaf length (stretched out).	Ht. 11" to top of stand. 16" leaf length (stretched out).
	Visually - Syn-T has higher growth, otherwise both look same.	
12/1/88	Ht. 10" Straight leaf ht. 14". Leaf width 1.0 cm. Finer blade than Syn-T. Slightly darker green 100% ground cover.	Ht. 11.5" Straight leaf ht. 17". Wider leaves - 1.5 cm. Coarser blade then Aroostook. Shade lighter green. 100% ground cover.
	Visually - The Syn-T has higher growth height than Aroostook, Syn-T is slightly lighter green in color, and Syn-T has a wider, broader leaf giving it more of a coarse leaf look.	

1/19/89 (no snow cover so far this winter).	15 cm. high. 10-15% browning of leaves. Looks green for most part. 100% cover of soil.	17 cm. high. 90% browning of leaves. Looks brown since Jan. Shade lighter green. 100% cover of soil.
4/14/89	28 cm. high. Leaves greened-up and started growing last week of March. 10% brown leaves. 90% soil cover.	23 cm. high. Leaves very pale light green. Plants started April 1. 50% brown leaves. 50% cover of soil with live plants.
5/4/89	65 cm. high - 1 cm. leaf width. 150 stems/sq. ft. Finer leaves. Deep green leaf color. 95% cover. Vigor rating of "excellent" (Rating = 1).	45 cm. high - 1.5 leaf width. 60 stems/sq. ft. Coarser, wider leaves. Pale green leaf color. 65% cover. Vigor rating of "fair". (Rating = 4).

Took 3 - 1 sq. yd. above ground biomass and leaf and root samples. Green and dry weights are to be taken. Plots sprayed with "Roundup" on 5/4/89.

Comparison Study of Syn-T vs. Aroostook Rye
Big Flats Plant Materials Center, Big Flats, NY
(as submitted by Martin van der Grinten, USDA-SCS Mgr., NY)

Green Weights	Aroostook Rye	Syn-T Rye
May 4, 1989		
Rep 1	1.12 kg. (2.50 lb.)	0.42 kg. (0.90 lb.)
Rep 2	1.12 kg. (2.50 lb.)	0.32 kg. (0.70 lb.)
Rep 3	0.98 kg. (2.15 lb.)	0.26 kg. (0.60 lb.)
Roots & Stems	0.40 kg. (0.90 lb.)	0.26 kg. (0.60 lb.)

Dry Weights	Aroostook Rye	Syn-T Rye
Rep 1	0.18 kg. (0.40 lb.)	0.12 kg. (0.25 lb.)
Rep 2	0.18 kg. (0.40 lb.)	0.10 kg. (0.20 lb.)
Rep 3	0.20 kg. (0.45 lb.)	0.08 kg. (0.20 lb.)
Aug. 3, 1989		
Roots & Stems	0.20 kg. (0.45 lb.)	0.16 kg. (0.35 lb.)

Clipping at Big Flats PMC from Fall 1988 Seedings in Block 1.

INITIAL EVALUATION OF EASTERN GAMAGRASS (*TRIPSACUM DACTYLOIDES*)

Extensive acreage within the Northeast is planted to corn silage. Oftimes the crop is harvested too late to allow for the establishment of adequate winter cover, resulting in widespread soil erosion. The identification and improvement of a perennial grass for use as silage would be of great benefit in reducing the amount of soil lost to field runoff. Soil erosion would be further reduced through the introduction of a highly productive and palatable forage grass for use on marginal cropland.

Eastern gamagrass (*Tripsacum dactyloides*) is a tall, perennial, warm-season bunch grass. Native populations are typically monoecious with the pistillate spikelets located below the staminate on terminal racemes. Distribution is from Massachusetts west to Nebraska, south to Texas and Florida. Eastern gamagrass grows in drainage areas, streambanks, and moist places. The grass is highly productive and extremely palatable, oftimes, being greatly reduced in natural stands through preferential grazing. However, widespread use of of Eastern gamagrass has been hindered by low seed production, inferior seed quality, lack of natural persistence, and difficulties with vegetative propagation.

In 1981 a mutant sex form (GSF I) was collected from Ottawa County, Kansas. GSF-I exhibited gymonoecy with pistillate spikelets below and perfect spikelets above. As a result, the number of pistillate spikelets increased by approximately twenty five-fold leading to a large potential increase in the amount of seed production.

The Cape May PMC is currently evaluating 106 accessions of Eastern gamagrass, 59 accessions of which represent native material with normal seed production (monoecious sex form or MSF) and 47 accessions which represent sexually-deviant material (gymonoecious sex form or GSF) received from the USDA/ARS Woodward, Oklahoma Experiment Station. Upon completion of initial evaluation, promising accessions will be entered into an intensive breeding program and examined for the eventual release of a superior Eastern gamagrass accession that is adapted to the mid-Atlantic region and that will segregate for the two sex forms.

To date, nineteen (19) gymonoecious sex form (GSF) accessions and fifteen (15) monoecious sex form (MSF) accessions were noted as superior for the Cape May PMC initial evaluation. However, several of the MSF accessions may be polyploid, thus further examination is necessary before the initiation of the intensive breeding program.

Relative Superiority of Gymonoecious Sex Form (GSF) Accessions for the 1990 Evaluation Season 1/

Acc. No	Alt. No.	Overall Rank 2/
9049980	K-6	1
9049993	K-30	2
9051607	WW-1692	3
9051610	WW-1695	4
9051603	WW-1688	5
9049990	K-26	6
9051602	WW-1687	7
9051614	WW-1699	8
9051620	WW-1705	9
9051612	WW-1697	9
9051622	WW-1707	10
9051624	WW-1709	11
9051613	WW-1698	12
9051611	WW-1696	13
9051627	WW-1712	13
9051601	WW-1686	14
9049989	K-25	15
9049977	K-2	16
9049997	K-39	17

1/ Planting established May 9 to June 8, 1990; Planting located in Field 30, Cape May PMC. Currently 59 Gymonoecious Sex Form accessions are included in the initial evaluation.

2/ Relative ranking is based upon the following parameters: transplant survival, vigor, forage production, insect/disease resistance, seed production, growth form, and various flowering characteristics.

Relative Superiority of Monoecious Sex Form (MSF)
Accessions for the 1990 Evaluation Season 1/

Acc. No.	Collection Site	Overall Rank 2/
9061152	Virginia Beach, VA	1
9057803	Virginia Beach, VA	2
9057793	Anne Arundel Co., MD	3
9057806	Prince George Co., MD	4
9057800	Cape May, NJ	5
9057807	Woodbine, NJ	6
9061210	Amherst Co., VA	7
9057810	Upper Twp., NJ	8
9057796	Baltimore, MD	8
9057811	Corbin City, NJ	9
9061151	Petersburg, NJ	9
9057808	Cape May, NJ	10
9057799	West Cape May, NJ	11
9057797	Atlantic Co., NJ	12

1/ Planting established May 9 to June 8, 1990, Field 30, Cape May PMC. Currently 47 Monoecious Sex Form accessions are included in the initial evaluation.

2/ Relative ranking is based upon the following parameters: transplant survival, vigor, forage production, insect/disease resistance, seed production, growth form, and various flowering characteristics.

INITIAL EVALUATION OF COMMON SAINFOIN (ONOBRYCHIS VICIAFOLIA)

Both wind and water erosion forces carry off excessive amount of soil from conventionally tilled cropland which doesn't employ the use of winter cover crops. This also holds true for cropland which lays fallow. Numerous annual grains have been used to control these erosive forces during the non-growing season, such as cereal rye, winter wheat, and oats. The use of permanent cover crops is now being pursued under new conservation tillage concerns. Legumes, in general, offer potentially more than just winter cover, such as the grains listed above; they possess the ability to make more nitrogen available for the primary crop. More available nitrogren overall often results in greater yields. Common sainfoin, one such legume, is currently being evaluated for its permanent vegetative cover attributes. This plant has the potential to be utilized for many conservation activites including critical area stabilization, no-till cropping systems, animal forage, wildlife cover, and permanent cropland cover; as well as revitalizing over-cropped land by adding more organic material and nitrogen fixation. All such uses of this Eur-Asian native will be considered after more is known of its growth characteristics and adaptability to the mid-Atlantic region.

In June of 1990, one hundred and fifty-six accessions held by the USDA, Agriculture Research Service, were planted in Field 2 of the Cape May Plant Materials Center in twenty foot rod rows. Within the first growing season, one hundred twenty-seven accessions emerged. The success of those accessions which did emerge varied greatly; the second growing season should confirm the performance of each accession. It was noted during December of 1990 that this species showed good vigor for most accessions with a vibrant dark green color. Evaluations will continue throughout 1991 and seed will be collected in the spring.

1990 Summary of the Top Twenty-Five Accessions
of Onobrychis viciafolia

1990 Cape May PMC Planting, F-2

34I129M

Table 1

Acc. No.	Origin	Highest Rank 1/	1990 Rank	Location (Tier/Row)
372829	Czech.	1	1	13/7
401468	Romania	2	2	8/7
313063	USSR	1	3	12/7
229613	Iran	3	4	6/4
313049	Poland	4	5	5/5
263159	USSR	6	6	13/8
372833	Czech.	5	7	8/4
318604	Switz.	7	8	12/10
368034	Turkey	11	9	13/3
380949	Iran	5	10	9/5
383716	Turkey	6	11	13/4
313046	Spain	7	12	12/9
400305	Rhodesia	6	13	12/8
372832	Czech.	10	14	6/2
316296	USSR	8	15	7/5
258770	USSR	-	16	6/3
258777	USSR	-	17	3/10
313057	USSR	-	18	5/7
401715	USSR	-	19	10/6
306693	Italy	-	20	11/5
313058	USSR	5	21	4/10
313064	Italy	-	22	9/12
318603	Switz.	9	23	4/9
313062	USSR	-	24	12/5
313053	USSR	-	25	8/2

1/Highest rank held during 1990

1989-90
TIDAL ZONE STABILIZATION PROJECTS

ADVANCED EVALUATION OF SMOOTH CORDGRASS (*SPARTINA ALTERNIFLORA*)

SMOOTH CORDGRASS (*SPARTINA ALTERNIFLORA*) FOR TIDAL BANK STABILIZATION

The banks of river estuaries and coastal sounds are exposed to strong storms and fluctuating water levels and, as result, are undergoing severe erosion problems. The erosion of river estuaries and coastal sounds is extensive in Virginia, North Carolina, Maryland, New Jersey, and Delaware. It is estimated that over 6000 acres of valuable land is being lost from these areas annually.

Smooth cordgrass (*Spartina alterniflora*) is a salt tolerant perennial species which grows in the intertidal zone of saline and brackish marshes and along river banks. The grass is characterized by long, slender, flexible culms and a thick rhizomonous root system. Planted along the shoreline, the smooth cordgrass absorb wave energy and collect the sediment brought in by the water currents. As the sediment is dropped, the band of vegetation expands, pushing the mean high tide line away from the tow of the bank, reducing the potential for continuing erosion.

The Cape May PMC began initial evaluation of 111 accessions of smooth cordgrass in 1977. In 1988 three accessions were selected for advanced evaluation: PI-421162, PI-421200, and PI-421228. After evaluation at various planting sites in Virginia and Maryland and after being evaluated in field plantings in North Carolina and New Jersey, two accessions, PI-421200 and PI-421162, have been placed in final evaluation. Release of a superior smooth cordgrass accession for use in the Mid-Atlantic region is anticipated in the near future. At the time of release, this accession will become the recommended plant for use in conjunction with 'Avalon' saltmeadow cordgrass (*Spartina patens*) for the restoration and stabilization of saline/brackish marshes, tidal banks, and river banks.

1989-90
WIND DIVERSION PROJECTS

1. HERBACEOUS WIND BARRIERS FOR CROP PROTECTION

FINAL REPORT

2. EVALUATION OF EASTERN RED CEDAR
(*JUNIPERUS VIRGINIANA*)
FOR SCREENS AND WINDBREAKS

HERBACEOUS WIND BARRIERS FOR CROP PROTECTION

FINAL REPORT

The effects of wind can not only cause erosion but also plant damage by desiccation, physical injury such as the tearing and breakage of tissue, blasting soil, ice or salt particles, killing buds and dwarfing plant size. Field crop protection can be gained by establishing wind barriers which are rows of narrow strips of vegetation at designed intervals. The spacing of the wind barriers depend on wind direction, soil erodibility, surface crop residue, soil loss tolerance, crop tolerances and equipment size.

Plant species to be used as wind barriers must meet certain requirements. The plants must grow to a minimum height of three to four feet. A plant provides a wind protection zone that has a width ten times the plant's height. Wind barrier species must also be upright, resistant to lodging and dense. Wind barriers can be planted in single rows if the plant species is dense or can be planted in double rows to insure adequate plant density for wind protection. Plant species must also be adapted to a wide range of conditions. Cultural requirements include easy establishment, a tolerance to herbicides used on the adjacent field crops, and a minimal ability to spread reproductively. An added desirable characteristic of wind barriers is that they will provide wildlife habitat. Employing herbaceous plants as wind barriers allows for easy establishment, quick growth, low-costs and maintenance, simple removal and relocation if desired. The objectives of this study were to determine the adaptation for several herbaceous species to the northeast and to evaluate those that are adapted to the area for vegetative wind barriers to reduce wind erosion on cultivated cropland.

A study was initiated in the Spring of 1987 to evaluate 24 annual and perennial grasses and forbes, representing 16 species. These included: six accessions of blue wildrye (Elymus glaucus); two accessions of mammoth wildrye (E. giganteus); two accessions of sand wildrye (E. arenarius); altai wildrye (E. angustus); basin wildrye (E. cinereus); three accessions of tall wheatgrass (Agropyron elongatum); thickspike wheatgrass (A. dasystachyum); rush wheatgrass (A. varnense); agrotricum (Agrotricum sp.); sorghum (Sorghum sp.); coastal panicgrass(Panicum amarum var. amarulum); switchgrass (P. virgatum); plumegrass (Erianthus ravenae); Chinese silvergrass (Miscanthus sinensis) and maximilian sunflower (Helianthus maximiliani). Evaluations taken were emergence, vigor, stand, plant height, plant width, disease and insect injury, reproductive stage, percent dormancy, wind barrier effectiveness

rating, regrowth height and percent density at prescribed heights.

Of the 24 accessions planted, ten either failed to emerge or performed poorly and were eliminated from the study. These included the six accessions of blue wildrye, the two accessions of sand wildrye, 'Largo' tall wheatgrass and Chinese silvergrass. The 1987 plant height and width measurements of the remaining 14 accessions are presented in Table 1. The accessions that obtained the minimum desirable height of three feet (91 cm) for a wind barrier during 1987 were 'Atlantic' coastal panicgrass, 'Shelter' switchgrass, and maximilian sunflower. Atlantic coastal panicgrass and maximilian sunflower also obtained a fair amount of plant width. The evaluations of plant height, width and percent density at prescribed heights were taken during the summer of 1988 and are found in Table 2. Three accessions required spring reseeding, sorghum which is an annual, basin wildrye and thickspike wheatgrass; subsequently, these last two, which are perennials, did not obtain much growth by the summer evaluations. Plumegrass and maximilian sunflower were the tallest accessions while PI-478832 mammoth wildrye and rush wheatgrass were the widest accessions. Agrotricum failed to reach the required minimum height for a wind barrier. Another of the most important features of wind barrier species is plant density. The plants should be very dense to the minimum height of three feet. The two accessions of tall wheatgrass, Atlantic coastal panicgrass, Shelter switchgrass and plumegrass met this requirement for 1988. In the spring of 1989, the evaluations of plant height, regrowth height, plant width and percent density at prescribed intervals were taken and are presented in Table 3. Most of the accessions having the required minimum height had a large percentage of their height attributed to 1988 growth rather than regrowth tissue. The exceptions to this are the two accessions of mammoth wildrye. Plant width also followed suit. The spring measurement of percent plant density, shows the accession's ability to provide an effective wind barier through the winter months and into the spring, coinciding with the time young, tender plants would be in the fields. The five accessions that performed the best in terms of plant density in the fall of 1988 also performed the best in the spring of 1989. These include the two accessions of tall wheatgrass, Atlantic coastal panicgrass, Shelter switchgrass and plumegrass. During the winter, some plant density was lost at the three foot and above level from these five accessions.

Of the original 24 accessions planted in 1987, ten proved to be unsatisfactory as wind barrier species. Of the remaining 14 accessions, five were judged superior performers. 'Alkar' and 'Jose' tall wheatgrass, Atlantic coastal panicgrass, Shelter switchgrass and plumegrass were suited to the requirements of a wind barrier species. They grow a minimum of three feet tall, provide a dense vegetation to at least this height and the vegetation obtained during one growing season provides effective wind protection during the winter and early spring months. These

accessions were easy to establish and did not require reseeding. Since all five accessions are bunchgrasses, they are easily confined to a narrow row. Atlantic coastal panicgrass and switchgrass produced adequate growth during the year of establishment while the two accessions of tall wheatgrass and plumegrass obtained adequate growth in the second growing season. The five accessions proved to be well adapted to the local coarse textured soils and droughty conditions. An additional advantage of the five accessions is that they provide adequate wildlife habitat.

Table 1

Evaluations of Herbaceous Species for Wind Barriers, 1987[1/]

Species	Plant Height (cm)[2/]	Width of Two Rows 18" Apart (cm)[2/]
Prairieland altai wildrye *Elymus angustus*	28	83
478831 basin wildrye *E. cinereus*	17	62
Volga mammoth wildrye *E. giganteus*	54	102
478832 mammoth wildrye *E. giganteus*	64	101
Alkar tall wheatgrass *Agropyron elongatum*	23	81
Jose tall wheatgrass *A. elongatum*	34	94
Critana thickspike wheatgrass *A. dasystachyum*	13	62
281863 rush wheatgrass *A. varnense*	24	83

Table 1
(cont.)

Evaluations of Herbaceous Species for Wind Barriers, 1987[1/]

Species	Plant Height (cm)	Width of Two Rows 18" Apart (cm)
W-21 wheat x 'Jose' tall whtgr. *Agrotricum* sp	44	89
WGF sorghum *Sorghum* sp.	81	106
Atlantic coastal panicgrass *Panicum amarum* var. *amarulum*	118	138
Shelter switchgrass *P. virgatum*	104	110
237795 plumegrass *Erianthus ravenae*	57	114
Prairie Gold maximilian sunflower *Helianthus maximiliani*	154	130

1/Herbaceous wind barriers seeded on June 9, 1987; Data recorded August 12 to November 9, 1987.

2/Values are an average of four measurements taken from two 20' rows.

Table 2

Evaluations of Herbaceous Species for Wind Barriers, 1988[1/]

Acc./Species	Plant Height (cm)[2/]	Width of Two Rows 18" Apart (cm)[2/]	Percent Density Across Two Rows. Top Growth Intervals (30 cm) 30	60	90	120	150	180[2/]
Prairieland altai wildrye *Elymus angustus*	100	130	100	60	10	0	0	0
478831[3/] basin wildrye *E. cinereus*	20	48	0	0	0	0	0	0
Volga mammoth wildrye *E. giganteus*	130	165	100	100	70	40	0	0
478832 mammoth wildrye *E. giganteus*	130	200	100	100	70	40	0	0
Alkar tall wheatgrass *Agropyron elongatum*	170	120	100	100	95	80	50	0
Jose tall wheatgrass *A. elongatum*	170	125	100	100	95	80	60	20
Critana[3/] thickspike wheatgr. *A. dasystachyum*	18	48	0	0	0	0	0	0
281863 rush wheatgrass *A. varnense*	160	190	100	90	80	70	50	0

Table 2
(cont.)

Evaluations of Herbaceous Species for Wind Barriers, 1988[1/]

Acc./Species	Plant Height (cm)	Width of Two Rows 18" Apart (cm)	Percent Density Across Two Rows. Top Growth Intervals (30 cm)					
			30	60	90	120	150	180
W-21 wheat X 'Jose' wheatgrass *Agrotricum* sp	80	65	95	80	10	0	0	0
WGF[3/] sorghum *Sorghum* sp.	120	125	100	100	60	40	0	0
Atlantic coastal panicgrass *Panicum amarum* var. *amarulum*	160	185	100	100	95	80	20	0
Shelter switchgrass *P. virgatum*	150	135	100	100	100	90	10	0
237795 plumegrass *Erianthus ravenae*	240	155	100	100	100	95	70	40
Prairie Gold maximilian sunflower *Helianthus maximiliani*	200	165	70	80	100	100	100	60

1/Herbaceous wind barriers seeded on June 9, 1987; Data recorded February 18 to August 25, 1988.
2/Values are an average of four measurements taken from two 20' rows; Evaluations taken July 28, 1988.
3/Herbaceous wind barrier species reseeded on May 12, 1988.

Table 3

Evaluations of Herbaceous Species for Wind Barriers, 1989[1/]

Accession/Species	Plant Height (cm)	Regrowth Height (cm)	Width of Two Rows 18" Apart (cm)	Percent Density Across Two Rows. Top Growth Intervals (30 cm)					
				30	60	90	120	150	180
Prairieland altai wildrye *Elymus angustus*	90[2/]	90[2/]	100[2/]	100	90	10	0	0	0
478831 basin wildrye *E. cinereus*	50	50	60	30	0	0	0	0	0
Volga mammoth wildrye *E. giganteus*	130	100	110	100	100	30	0	0	0
478832 mammoth wildrye *E. giganteus*	120	100	130	100	100	10	0	0	0
Alkar tall wheatgrass *Agropyron elongatum*	170	100	110	100	100	80	30	10	0
Jose tall wheatgrass *A. elongatum*	180	100	110	100	100	70	30	10	0
Critana thickspike wheatgr. *A. dasystachyum*	30	30	50	20	0	0	0	0	0
281863 rush wheatgrass *A. varnense*	160	80	110	100	100	60	30	0	0
W-21[3/] wheat X 'Jose' wheatgrass *Agrotricum* sp	80	0	50	90	30	0	0	0	0
WGF[3/] sorghum *Sorghum* sp.	70	0	60	90	20	0	0	0	0

Table 3
(cont.)

Evaluations of Herbaceous Species for Wind Barriers, 1989[1/]

Atlantic coastal panicgrass *Panicum amarum* var. *amarulum*	180	2	140	100	100	90	70	20	0
Shelter switchgrass *P. virgatum*	150	0	110	100	90	80	20	0	0
237795 plumegrass *Erianthus ravenae*	280	70	130	100	100	90	60	20	20
Prairie Gold maximilian sunflower *Helianthus maximiliani*	225	20	200	70	20	10	10	10	10

1/Herbaceous wind barriers seeded on June 9, 1987; Data recorded April 24 to September 26, 1989.

2/Values are an average of four measurements taken from two 20' rows; Evaluations taken April 28, 1989.

3/Herbaceous wind barrier species reseeded on May 24, 1988.

EVALUATION OF EASTERN RED CEDAR (*JUNIPERUS VIRGINIANA*) FOR SCREENS AND WINDBREAKS

High wind velocity is one of the most damaging natural agents to cropland located along the mid-Atlantic coastal plain. The prevailing currents often cause the transport of soil particles, resulting in erosion and widespread crop damage. Properly established windbreaks have proven effective in helping to reduce surface wind velocity. As such, the objective of this project is to evaluate Eastern red cedar (*Juniperus virginiana*) ecotypes for windbreak potential and to select a rapidly growing strain that possesses semi-dense foliage and elliptical form.

Eastern red cedar is an native conifer of wide distribution and great genetic diversity. Its adaptability to a variety of soil and climatic conditions has made the tree especially attractive for screening, windbarrier and landscape purposes.

As result of Eastern red cedar's inherent genetic diversity for growth form, crown density, seedling vigor, and growth rate, it is very important that the released variety be uniform and stable for these characteristics. Thus, in 1989 production was approached by both the development of improved seed stock and by vegetative propagation. If a successful propagation method can be developed, a superior form could be identified and clonally duplicated for use as a commercially available windbreak tree.

In 1988 selections were made for the best ecotypes remaining within the project. Twelve females and five males were chosen and transplanted into a polycross nursery in order to promote random cross-pollination. In November of 1989 seed was collected, mixed, and broadcast into woody beds for harvest during the 1991 season. At the time of harvest, seedlings will be used for the establishment of field plantings for final evaluation.

Although literature review indicates that the vegetative propagation of Eastern red cedar is difficult, several research teams have demonstrated improved success rates by varying the type and timing of cutting as well as through the use of non-traditional growth promoter treatments. In January, 1990 a vegetative propagation study was begun at the PMC. Lateral shoot cuttings were obtained from male and female trees, trimmed to approximately 6-inches, and subjected to the following growth promotion treatments:

Treatment 1: IBA (10,000 ppm) in 50% alcohol

Treatment 2: IAA (10,000 ppm) in 50% alcohol

Treatment 3: NAA (10,000 ppm) in 50% alcohol

Treatment 4: IBA (10,000 ppm) in 50% alcohol, 20% DMSO

Treatment 5: IBA (10,000 ppm) in 50% alcohol, 20% Dimethyl formamide

Treatment 6: Rootone (2000 ppm NAA, 1000 ppm IBA, 40,400 ppm Thiram)

Treatment 7: Control (untreated) in 50% alcohol

Cuttings were then placed into a bottom-heated propagation bench in the PMC greenhouse. Mist-irrigation was used to prevent dessication.

Indoleacetic acid (IAA) is a naturally occurring auxin-type plant hormone. Indolebutyric acid (IBA) and alpha napthalene acetic acid (NAA) are synthetically produced growth promoters. Likewise, "Rootone" is a commercially available talc-based growth promoter containing NAA, IBA, and Thiram, a fungicide. Dimethyl formamide and dimethyl sulfoxide (DMSO) are aprotic solvents with extremely high dielectric constants and, thus, which have the potential to increase the transport and incorporation of growth promoters and hormones into the target plant tissues.

After approximately 120 days of being maintained in the propagation bench, all cuttings were exposed, rinsed, and examined for mortality, callus production, and root production. Little difference was observed between the male and female accessions for the described parameters. However, strong differences were noted for the percent mortality, percent callus production, and percent root production between the various growth promotion treatments. The IBA, IBA & DMSO, IBA & dimethyl formamide, and IAA treatments were clearly superior to the NAA, "Rootone" and control treatments for root production.

Percent of cuttings with callus production and root production, and percent mortality for the 1989-90 low-cost methodology for the vegetative propagation of *Juniperus virginiana*. 1/

Treatment	Percent Mortality			Percent Callusing			Percent Rooting		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
IBA (10,000 ppm)	60	30	45	25	20	23	0	40	20
IAA (10,000 ppm)	50	70	60	10	10	10	30	10	20
NAA (10,000 ppm)	90	100	95	0	0	0	0	0	0
IBA (10,000 ppm) & DMSO (20%)	50	30	40	0	10	5	20	20	20
IBA (10,000 ppm) & dimethyl formamide (20%)	40	30	35	0	0	0	30	0	15
Rootone	90	100	95	0	0	0	0	0	0
Control	40	70	55	10	30	20	0	0	0

1/ Evaluation began on Jan. 31, 1990. Evaluation completed on July 6, 1990. Twenty cuttings total (ten male - 9047099, ten female -9047095) were evaluated per treatment.

1989-90
MISCELLANEOUS PMC PROJECTS

INITIAL EVALUATION OF VETIVER GRASS (*VETIVERIA ZIZANIOIDES*) FOR ADAPTABILITY TO THE MID-ATLANTIC SERVICE AREA

INITIAL EVALUATION OF VETIVER GRASS (*VETIVERIA ZIZANIOIDES*) FOR ADAPTABILITY TO THE MID-ATLANTIC SERVICE AREA

Vetiver grass (*Vetiveria zizanioides*) is an Asian species that is primarily used for vegetative contour hedges and by the perfume industry. It is a densely tufted bunchgrass with stout culms up to 2 meters (6 feet) in height and terminal flowers consisting of numerous narrow racemes oriented in whorls along a central axis. Vetiver grass has an extensive branching root system that is considered useful for the prevention of soil erosion. Vetiver had been reported to lack viable flowers, rhizomes, or stolons, instead being propagated soley by root division or vegetative slips. However, two ecotypes of the grass have recently been documented: (1) a northern flowering type and (2) a southern non-flowering type. The two ecotypes differ in physiochemical characteristics, essential oil yield, and drought tolerance. Vetiver is native to warmer climates, being best suited to temperatures ranging from 21.0 to 43.5ˆC. Prior to introduction to the mid-Atlantic region, the northern-most successful planting has been in Rome, Italy, roughly 42ˆN in latitude and Mediterranean in climate.

The Cape May PMC currently is examining four accessions of vetiver grass:

196257 - Imported by the USDA/ARS Southern Regional Plant Introduction Station in 1951. No other available information.

213903 - Imported by the USDA/ARS Southern Regional Plant Introduction Station. Originally collected near Allahabad, India.

271633 - Collection number 1027 by the USDA/ARS, as imported through the Southern Regional Plant Introduction Station. Original collection site was located 18 km. north of Karmola, India.

302300 - Collection number A-7016 from India, as presented to the USDA/ARS Southern Regional Plant Introduction Station by Oklahoma State University.

All accessions were sent to the Cape May PMC as two year-old stock from the National PMC in Beltsville, Maryland. On May 3, 1990, eighteen (18) plants from each accession were outplanted on the PMC. The predominant goals for the PMC evaluation are:

1. To note adaptability of vetiver to the Mid-Atlantic service area;

2. To examine relative performance of the included accessions;

3. To examine vetiver for potential use in herbaceous windbarriers for the Mid-Atlantic Service Area; and

4. To note flower production, seedset, and subsequent germination for the included accessions.

Initial survival for the four accessions was 100 percent, with 271633 consistently exhibiting superior height, culm density, and vigor for the 1990 evaluation season. All accessions exhibited extensive flowering and seedset.

On October 29, 1990, seed was collected from each of the four accessions being examined by the Cape May PMC. All seed was cleaned using hand removal of the spikelets from the collected panicles with subsequent processing through a Clipper desk-top cleaner using a number 7 top-screen, a number 1/20 bottom-screen, and minimal air. On December 18, 1990, after treatment with Captan 50W fungicide, thirty two (32) seeds were planted from each of the four accessions for the following treatments:

1.) 30-day cold, moist stratification;

2.) 30-day cold, dry stratification;

3.) control treatment.

On January 22, 1991, after 35 days of being placed within the Cape May greenhouse, the cold, dry stratification treatment was noted as being the most successful. However, the total emergence for the cold, dry treatment was only 10.4%. In comparison, the emergence for the cold, moist treatment was 3.1% and the emergence for the control treatment was 6.3%. Accession 271633 had the best emergence with 8.3% total for all three treatments. Accession 196257 had the poorest emergence with approximately 2.1% total for all three treatments. Despite the relatively low emergence, the fact that viable seed formation did occur may indicate that all four accessions represent the northern India sexually reproducing ecotype.

Seed Germination Data for the Initial Evaluation of 1/ *Vetiveria zizanioides*, Cape May PMC, January 22, 1991

Acc. No.	30-Day Cold and Moisture Treatment	30-Day Cold Treatment	Control	Total
196257	1	1	0	2
271633	2	4	2	8
302300	0	1	2	3
213903	0	4	2	6
TOTAL	3	10	6	19

1/ 32 seeds were planted for each accession for each treatment on Dec. 18, 1990. All material was planted in 3-inch peat pots and maintained in the PMC greenhouse. All seed was collected from the Cape May PMC Field 9 on Oct. 29, 1990. Seed was cleaned using hand removal of spikelets from the panicle, followed by subsequent processing through a Clipper desk-top cleaner using a number 7 top-screen, a number 1/20 bottom-screen, and minimal air. All seed was treated with Captan 50W fungicide before undergoing stratification.

CAPE MAY PMC CROP HISTORY

Field No.	1989	1990
1	Inter-Center Strain Trial Test; *Uniola paniculata*, sea oats Nursery *Cynodon dactylon*, 'Tufcote' Bermuda grass	Same as '89
2	Vacant/summer & winter cover crop	*Onobrychis viciafolia*, sainfoin; *Anthoxanthum odoratum*, sweet vernalgrass
3&4	*Panicum virgatum*, NJ-50 switchgrass	Same as '89
5&6	*Juniperus conferta*, 'Emerald Sea' shore juniper; *Myrica pensylvanica*, bayberry; *Prunus maritima*, beach-plum; *Lathyrus sylvestris*, 'Lathco' flatpea	JUCO, shore juniper; MYPE, bayberry; PRMA, beachplum
7	*Elaeagnus umbellata*, autumn olive Various woody production species	Same as '89
8	*Panicum virgatum*, switchgrass	Vacant/summer & winter cover crop
9	Initial Increase Field	Same as '89
10	*Secale cereale*, 'Syn-T'cereal rye production	Vacant/summer & winter cover crop
11	Vacant/summer & winter cover crop	*Secale cereale*, Comparative Study, 'Syn-T' vs. Aroostook; Cold Tolerant Cover Crop Study; Herbaceous Wind Barrier Study.
12	Vacant/summer & winter cover crop	*Panicum amarum* var. *amarulum* 'Atlantic' coastal panicgrass produciton.
13	*Secale cereale*, 'Syn-T' cereal rye production	*Lespedeza thunbergii*, 'VA-70' shrub lespedeza production
14	*Lespedeza thunbergii*, 'VA-70' shrub lespedeza production	Same as '89
15	*Spartina alterniflora*, smooth cordgrass increase	SPAL, smooth cordgrass; *Ammophila breviligulata*, 'Bogue' American beachgrass increase
16	Natural - Wildlife Area	Same as '89
17	Permanent Grass Cover	Same as '89
18	*Robinia pseudoacacia*, black locust holding block	Same as '89

Field No.	1989	1990
19	Rosa rugosa, poly cross; Ammophila breviligulata, 'Hatteras' American beachgrass increase; Spartina patens, saltmeadow cordgr.; Brassica pekinensis, Peking cabbage	Same as '89
20	Permanent Cover Crop	Same as '89
21	Ammophila breviligulata, American Beachgrass Longevity Study	Vacant/cereal rye winter cover
22	Woody tree and shrub holding block	Same as '89
23	Vacant/summer & winter cover crop	Panicum amarum var. amarulum 'Atlantic' coastal panicgrass production
24& 25	Panicum amarum var. amarulum, 'Atlantic' coastal panicgrass production	Same as '89
26	Vacant/summer & winter cover crop	Avena sp., oat production
27	Vacant/summer & winter cover crop	Secale cereale, 'Syn-T' rye production; Water Quality-Nutrient Reclamation Study
28& 29	Vacant/summer & winter cover crop	Secale cereale, 'Syn-T' rye production
30	Lathyrus sylvestris, 'Lathco' flat pea Cropping Study; summer & winter cover crop	Lathyrus sylvestris, 'Lathco' flatpea; Tripsacum dactyloides, IE of
31	Vacant/ summer & winter cover crop	Ammophila breviligulata, 1991 'Cape' American beachgr. Prod.
32	Juniperus virginiana, eastern red cedar; Spartina patens, 'Avalon' saltmeadow cordgrass production	Juniperus virginiana, eastern red cedar; Spartina patens, 'Avalon' production; Carex kobomugi, 'Sea Isle' Jap. sedge production
33	Ammophila breviligulata, '89 Cape' American beachgrass production	Vacant/summer&winter cover crop
34	Ammophila breviligulata, '90 Cape' American beachgrass production	Same as '89
35,36 37,38	Hay/Alfalfa & Fescue Cover	Same as '89
39	Vacant/summer & winter cover-crop	Glycine max, soybeans for wildlife and cover
40	Myrica cerifera, wax myrtle holding block; Lonicera maackii, 'Rem-Red' amur honeysuckle seed orchard.	Same as '89

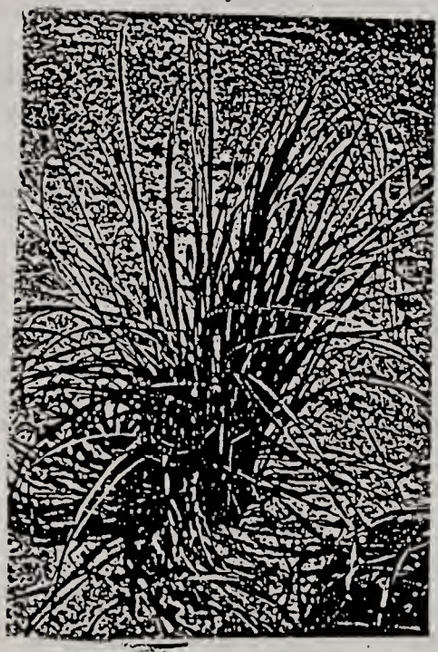
PLANT DESCRIPTIONS
of Commercially Released Cultivars

'Rem-Red' Amur Honeysuckle (Lonicera maackii)

'Rem-Red' is a multi-stemmed, vase-shaped shrub that grows to a height of 8 to 12 feet. The plant is well suited for ornamental use or as a screen on large lots. Its primary use is to supply a source of food for wildlife during the critical winter period.

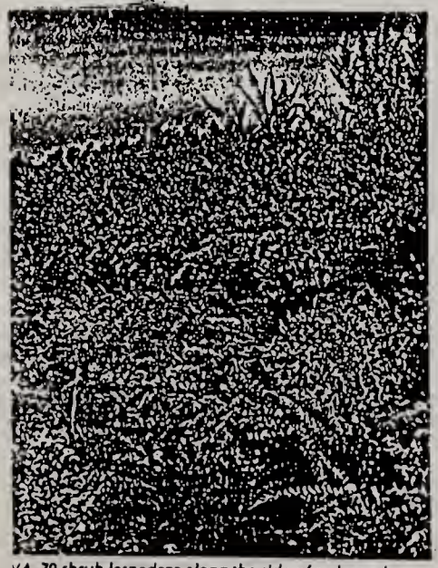
The plant's bright red fruit is about one-fourth inch in diameter and matures in late September and October. Amur honeysuckle grows best on deep, well-drained soil. The plant grows well in slightly acid soils with a sandy, loamy, or moderately clayey texture.

Rem-Red was released in 1970 as a multi-purpose plant. An adequate seed supply exists for commercial production.



'Cape' American beachgrass (Ammophila breviligulata)

'Cape' was released for commercial production in 1972. It is a superior strain of American beachgrass. It is used along the mid-Atlantic coast for initial stabilization and establishment of sand dunes. Cape is robust, easy to plant, and spreads rapidly by vigorous rhizomes. It has healthier leaves and thicker culms or stems than common American beachgrass. An adequate supply of Cape beachgrass plants are available for commercial production.



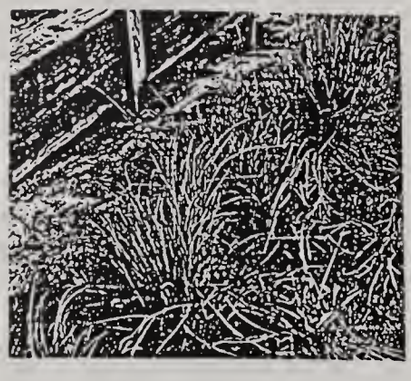
VA-70 shrub lespedeza along the side of a channel.

'VA-70' Shrub Lespedeza (Lespedeza thunbergii)

'VA-70' shrub lespedeza is a herbaceous legume with a semi-woody stem. It is an upright perennial with stems growing 4 to 6 feet tall. The leaves are more linear than oval and are approximately 2 inches long and one-half inch wide. Attractive pink to purple flowers appear in late summer. It is an excellent source of winter food and habitat for wildlife. Pheasants and bobwhite quail use its seed for food in fall and winter. Rabbit and deer browse the leaves and bees produce honey from the flowers.

You can use VA-70 shrub lespedeza almost anywhere that shrubs are appropriate. When used in hedges and borders, VA-70 is an attractive landscape feature. The plant is particularly well suited to seeding steep banks along channels and ditches or for wildlife borders along these water courses. It is useful as a border between cropland and woodland, as contour hedges between crop strips, along diversion terrace boundaries, and in small odd areas set aside for wildlife.

VA-70 shrub lespedeza can be used alone or with other plants. An adequate supply of seed is available for commercial production.



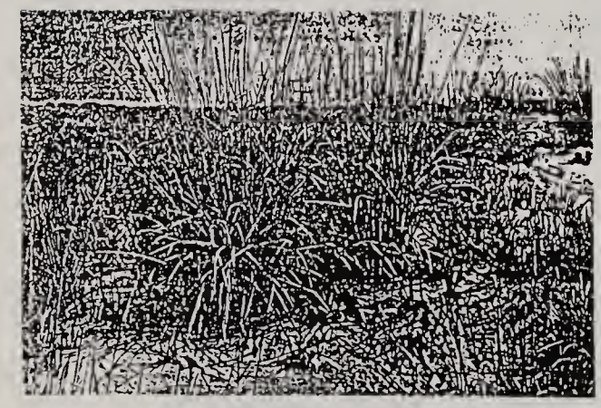
'Avalon' Saltmeadow Cordgrass (Spartina patens)

'Avalon' is a strongly rhizomatous, salt tolerant perennial grass that grows up to 2-1/2 feet tall. Its rhizomes are long and slender and produce most of the new growth.

Avalon is unique in that it spreads quickly and produces a more dense root system and finer roots than most other saltmeadow cordgrass strains.

The principal conservation use of Avalon is to vegetate and restabilize brackish and fresh water tidal streambanks. It is salt tolerant and can be established immediately above the mean high tide elevation. It is well adapted to a range of soils, will tolerate occasional inundation by storm tides, and has the ability to trap and grow through thin layers of sand. Avalon is also adapted to low elevation coastal sand dunes and can be used to supplement other sand dune vegetation.

For establishment, both potted and bare-root plants can be used. An adequate supply of bare-root plants is available for commercial production.



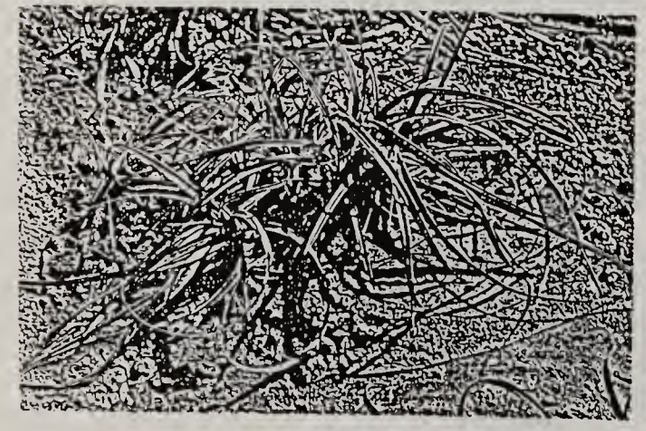
'Atlantic' Coastal Panicgrass (Panicum amarum var. amarulum)

'Atlantic' is a tall, robust, native warm season perennial grass. Its growth habit is upright, with stems reaching a height of 4 to 6 feet. The plants have the appearance of a bunch grass, although they produce short rhizomes. Atlantic has strong seedling vigor and reliable seed production under cultivation. It performs satisfactorily on sandy, droughty infertile soils and on heavy imperfectly drained soils.

The principal use of Atlantic is for stabilizing disturbed sandy sites. It can be direct seeded on sand dunes except for active frontal dunes. It has also been successfully established on surface mined areas, sanitary land fills, dredged spoil fills, sand and gravel mines, road side embankments and similar disturbed areas. While most stands of Atlantic are established by drilling the seed, small areas can be vegetated with seedling plants.

Field tests show Atlantic to be well adapted in the coastal plain and piedmont region from Massachusetts to Texas. It has also been grown inland in Pennsylvania and Ohio. Atlantic's resistance to lodging and its seed production also enhance its value as food and cover for wildlife.

It was cooperatively released by the Soil Conservation Service and the New Jersey Agricultural Experiment Station in 1981. Limited quantities of seed are available for commercial production.



'Sea Isle' Japanese Sedge (Carex kobomugi)

Japanese sedge has been introduced onto the dunes from New Jersey south to Virginia. It is native to northeastern Asia and exhibits several desirable characteristics for stabilizing sand dunes. Japanese sedge, a salt tolerant tufted plant, differs from most related sedges by growing in drier areas. The plant, which grows 8 to 10 inches tall, spreads primarily by short rhizomes which root at the nodes. Because of the short internodes, a mature stand of Japanese sedge is usually dense, with almost complete ground cover. This cool season plant remains green well into fall and can tolerate some, but not continuous, foot traffic.

'Sea Isle' tends to be long-lived on stable sand dunes. In addition, Japanese sedge appears to be tolerant of pests and low soil fertility. Consequently, Sea Isle may exist with less management. However, it will flourish under high levels of management such as routine fertilization and protection from pedestrian or vehicle traffic.

During the year of establishment, Japanese sedge has a higher mortality rate and exhibits little lateral spread when planted in spring. However, those established in the fall of the year prove to have good survival. Regardless, after the first year, stands of 'Sea Isle' continually improve in both vigor and density.

The plant was released in 1983 by the Soil Conservation Service and the New Jersey Agricultural Experiment Station. Limited quantities of plants are available for commercial production.

'Emerald Sea' Shore Juniper (Juniperus conferta)

'Emerald Sea' is a low-growing or trailing evergreen shrub which grows to approximately one foot in height. Its needles are greenish blue, softer than most junipers, and one-half to one inch long. The needles retain their blue-green color very well during the winter. Mass plantings produce a dense and uniform ground cover.

Shore juniper is well suited for planting on sand dunes near the seashore where other junipers do not grow successfully. It has good salt tolerance and grows well in sandy soils.

Emerald Sea is often used for mass or border plantings around buildings and as foreground for taller plant groups. It is also a versatile ground cover plant for steep banks around buildings, parks, and playgrounds.

An adequate supply of unrooted cuttings are available for commercial production.

1990 SEED PRODUCTION

Scientific Name	Common Name	Cultivar/Acc.	Weight
Juniperus virginiana	Eastern redcedar	8 Accessions	1059 gm.
Lespedeza thunbergii	shrub lespedeza	'VA-70'	210 lbs.
Myrica pensylvanica	bayberry	4 Accessions	12.3 lbs.
Panicum amarum var. *amarulum*	coastal panicgrass	'Atlantic'	820 lbs.
Panicum virgatum	switchgrass	PI-421138	551 lbs.
Prunus maritima	beachplum	4 Accessions	5474 gm.
Rosa rugosa	rugosa rose	515950	10.9 lbs.
Secale cereale	cereal rye	9047052	68 bu.
Solidago sempervirens	seaside goldenrod	5 Accessions	166 gm.
Uniola paniculata	sea oats	30 Accessions	3552 gm.

1990 VEGETATIVE PRODUCTION

Scientific Name	Common Name	Cultivar/ Acc.	Number Produced
Ammophila breviligulata	American beachgrass	'Cape'	160,000
" "	" "	'Bogue'	15,800
" "	" "	'Hatteras'	14,000
" "	" "	4 Other Acc.	68,600
Carex kobomugi	Japanese sedge	'Sea Isle'	30,000
Juniperus conferta	shore juniper	'Emerald Sea'	10,000 ctg.
Lonicera maackii	amur honeysuckle	'Rem-Red'	220
Myrica pensylvanica	bayberry	4 Accessions	2,600
Panicum amarum	bitter panicgrass	'Ocracoke'	3,300
" "	bitter panicgrass	3 Accessions	11,000
Prunus maritima	beach plum	4 Accessions	330
Rosa rugosa	rugosa rose	515950	225
Spartina alterniflo	smooth cordgrass	3 Accessions	5,100
S. patens	saltmeadow cordgrass	'Avalon'	39,000
" "	" "	421250	12,600
Uniola paniculata	sea oats	30 Accessions	3,200

SCS TRAINING RECEIVED

1989

July 17	Agronomist Trainee at the Cape May PMC: Randy Mandel
August 21-25	SAS training attended by Randy Mandel in College Park, MD
October 3-4	Plant Identification course taken by Randy Mandel at Rutgers Univ.

1990

March	"SCS-NJ Conservation for New Employees" held in Somerset, NJ attended by Michael Fournier
May 21-25	Farm Management and Agronomy Principles for PMC Biological Technicians attended by Noel Murray in Manhattan, KS
May 22-24	"SCS Management Level II Training" held in Somerset, NJ was attended by Michael Fournier
June 4-8	"Irrigation Water Management" given by SCS-NJ in Hammonton, NJ was attened by Michael Fournier and Noel Murray
June 18-22	SCS Field Office Training attended by Randy Mandel in May's Landing, NJ
September 25	Plant Materials Specialist training attended by Michael Fournier, Randy Mandel, and Sandra Primard in Ocean County, NJ; Instructor: Cluster Belcher
September	"Installation and Operation of Lysimeters" at the Univ. of Rhode Island was attended by Sandra Primard

PRESENTATIONS & PUBLICATIONS

1989

April 12	Presentation by Donald Hamer to Cape-Atlantic SCD on "Plant Materials Update"
April 20	Presentation by Donald Hamer at the ARS/SCS Joint Workshop on "Cold Tolerant Cover-Crops"
June 27	Presentation by Donald Hamer at the Budapest, Hungary Round Table Conference on "the Investigation of Black Locust Strains for Desirable Characteristics"
November 26	Article written by Donald Hamer in the Associated Press on "A Grass-Roots Effort in the Dunes"

1990

January 22-26	Presentation by Donald Hamer at National Plant Materials Conference in Baton Rouge, LA on "Flatpea as a Permanent Cover for No-till Corn"
February 14	Presentation by Donald Hamer at XXI International Erosion Control Conference in Washington D.C. on "Shoreline Stabilization with Cordgrass"
February 28	Live Radio Interview of Donald Hamer on the "USDA Plant Materials Centers" by WVSJ
March 9	Article written by Donald Hamer in the Atlantic City Press on "Pest Related Damage to American Beachgrass"
April 20	Article written by Donald Hamer & Dr. Michael Sullivan in the Atlantic City Press on "Nitrate Hungry Plants"
April 22	Exibit Displayed by Donald Hamer & Randy Mandel at the Cape May County Park Commission Earth Day Ceremonies
May 9	Wildwood Crest School Tour
May 16	Woodbine School Tour Presented by Donald Hamer & Randy Mandel
May 29	Workshop for Middle Township Elementary School on "Sand Dune Ecology" by Donald Hamer

September 15	Exhibit Displayed by Donald Hamer, Michael Fournier, Randy Mandel and Sandra Primard at the Wings and Water Festival held at the Wetlands Institute in Stone Harbor, NJ
October 4	Live Radio Interview of Donald Hamer on "Soil and Water Conservation" by WVSJ
	Live Radio Interview of Sandra Primard on the "Use of Plant Materials for Filtering Excessive Chemicals from Leachate" by WVSJ
October 24	Two PMC Field Tours presented by Michael Fournier, Randy Mandel, and Sandra Primard during the Cape May PMC 25th anniversary celebration
October 31	PMC Field Tour Presented by Donald Hamer, Michael Fournier, Randy Mandel, and Sandra Primard to the visiting NTC Plant Material Specialists
November 26	Presentation by Donald Hamer at the Northeast Plant Materials Workshop in Corning, NY on "Herbaceous Plants for Field Wind Barriers"
	Presentations by Sandra Primard at the Northeast Plant Materials Workshop in Corning, NY on "Plant Chemical Reclamation" and the "Breeding of an Improved Seed Producing Eastern Gamagrass"
December	Article written by Donald Hamer on "Shore Stabilization with Cordgrass" in the Public Works Journal: Vol.121 No.13